WH2CF 1.2
U1

Engineers
Planners
Economists
Scientists

Portland Office

December 12, 1991

PDX32451.J0

Mr. Jim Sims
Weyerhaeuser Company
P.O. Box 188
Longview, Washington 98632

Dear Jim:

Subject: Closure Cover System for No. 1 Cell Room Site

The purpose of this report is to present our assessment as to the closure of the No. 1 Cell Room Site in conformance with the requirements established in Washington State Department of Ecology (Ecology) agreed order No. 91-TCI 102. Other documents will be referred to and are listed in the appendices of this report. These documents are the Plan for Monitoring and Recording Lysimeter Data, Appendix A; the No. 1 Cell Room Site Grading and Paving Project Description, Appendix B; the report by Applied Geotechnical, Inc. (AGI) entitled Summary of Quality Control Services During Construction, Appendix C; and the report prepared by Terrel Research (TR) on the Polymer Modified Asphalt (PMA) Concrete, Appendix D.

Background

On August 15, 1991 CH2M HILL received a letter from Mr. Paul Seamons of Columbia Consulting Team requesting assistance in developing a plan to install an impermeable membrane or liner under asphalt pavement to be placed over the area previously occupied by the No.1 Cell Room. The purpose of the membrane was to satisfy the concerns of Weyerhaeuser and Ecology that rainwater and surface water not be allowed to percolate through the asphalt and into the underlying soils.

CH2M HILL looked carefully at the idea of using a membrane liner. It became apparent that a number of conditions existed that made the application of a membrane lining problematical. For example, the graded backfill soil elevation was too high to allow adequate spacing between the membrane, the catch basin piping, and the asphaltic concrete surface. The tolerance was so close that the membrane would be in jeopardy during other construction activities. CH2M HILL looked for suitable

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CH2M HILL Portland Office 2020 S.W. Fourth Avenue, 2nd Floor, Portland, OR 97201 503.224.9190
Corvallis Office 2300 N.W. Walnut Blvd, P.O. Box 428, Corvallis, OR 97339 503.752.4271

alternatives that would meet Ecology's goals for the cover system. These concerns regarding the membrane liner were presented to Ecology in a letter on August 28, 1991. The letter also presented a recommendation for an alternative cover system consisting of low permeability, polymer modified asphalt for the paving surface.

The polymer modified asphalt system was approved by Ecology with a provision that eight lysimeters be installed under the asphalt paving to detect changes in moisture content that could indicate leakage through the pavement. The provisions for the lysimeters were accepted and the final design and specification of the polymer modified asphalt was started.

Another issue evolved during the evaluation of the membrane lining and paving system. That issue was related to the suitability and strength of the proposed polyvinyl chloride (PVC) piping for the catch basins. The shallow soil cover over the piping would not adequately protect the PVC from traffic wheel loads and low temperature brittleness. CH2M HILL investigated the piping design and recommended an alternative ductile iron water pipe in a Technical Memorandum dated September 10, 1991. Recommendations were also made for ways to protect the pipe during installation of the pipe and the asphalt concrete.

Project Objectives

The objectives of the project were to fill the site to match the surrounding grade, install catch basins and culverts to drain the site, grade the site to drain to the catch basins, and pave the site. Weyerhaeuser had particular concerns about some of the details of the closure. These details are:

- Achievement of specified soil compaction
- Durability and impermeability of the drainage grid
- Durability and impermeability of asphalt pavement
- Positive drainage of all areas of the project site to catch basins without ponding

The reminder of this report will describe how all the project objectives were met.

Soil Compaction

The placement of import sand fill and base rock was observed and tested by representatives of AGI. Numerous field density tests were performed on the imported fill material. The AGI quality control report of November 11, 1991 indicates that the fill materials were placed in accordance with the specifications to achieve 95 percent of the modified maximum density. When observed before being paved, the finish grade of the compacted granular base rock appeared smooth and dense. The paving machinery caused little or no rutting on the prepared surface.

Drainage Grid

The catch basins and connecting piping were constructed according to the plans and specifications for the project. As mentioned earlier, the piping was changed to ductile iron water pipe for increased strength because of the shallow soil cover over the pipe. After the piping was installed between catch basins and the backfill was completed, the drainage system was tested for leaks. The testing procedure followed is described in the revised (9/20/91) No. 1 Cell Room Site Grading and Paving Project Description. The outlets of the pipes were plugged and the pipes filled with water to the top of the asphalt elevation. The water level was measured after 24 hours to verify that the drop in water level in the catch basins did not exceed 1.5 inches at grid line G and 1 inch in the catch basins south of grid line G.

During the paving operations only static compaction of the asphalt was allowed over the pipe zones. The durability of the drainage grid was achieved by using stronger ductile iron pipe, controlling the backfill around the pipe, and controlling the compaction of the asphalt over the pipe. After the pavement was installed, the impermeability of the drainage grid system was tested by monitoring the water level in the catch basins. The test showed no leakage.

After the paving was completed, the joint at the contact between the asphalt and the concrete catch basins was coated with hot aged residue (AR) grade liquid asphalt cement to seal the joint. This will limit the potential for water to leak through this joint.

Polymer Modified Asphalt

Upon notification that Ecology would consider polymer modified asphalt (PMA), CH2M HILL contacted Dr. Ron Terrel, developer of PMA, for guidance in the design of the PMA pavement. After discussions with Dr. Terrel concerning the suitability of the product and the timing of the project, Dr. Terrel contracted directly with Lakeside Industries of Longview, Washington for his involvement. Dr. Terrel revised the project paving specifications and developed a mix design for the PMA. To verify the mix design, samples of aggregate and polymer modified asphalt binder were mixed and tested at the Oregon State University Civil Engineering Laboratory in Corvallis, Oregon, under Dr. Terrel's supervision. The polymer modified asphalt was designed for low permeability and adequate strength for light traffic and vehicle parking.

Dr. Terrel also recommended that a trial section be paved to test the mix design. Test panels of PMA were constructed onsite on October 23, 1991. The AGI report contains the results of the trial section density tests and core samples taken from the test panels. After evaluation of the test panel results, (AGI report, Appendix C) the decision was made to adjust the job mix formula (JMF) to increase the asphalt content from 6.7 to 7.0 percent. The project specifications require the aggregate gradation to be similar to Washington State Department of Transportation (WSDOT) Class B asphalt. The adjusted JMF for the Ecomat is similar to Class B asphalt, as shown below.

	Percent Passing	
Sieve Size	Class B Mix	Adjusted JMF
5/8 inch	100	100
1/2 inch	96-100	98
3/8 inch	75-90	90
1/4 inch	55-75	70
No. 10	32-48	42
No. 40	11-24	18
No. 80	6-15	--
No. 200	5-10	7
Mineral Filler	0-2	--
Asphalt (% of total)	4-7.5	7.0

Production paving was done on October 29, 1991 under continuous observation and testing with a nuclear density gauge. Throughout the day, 107 nuclear density tests were performed at 50 to 100 foot intervals as the paving progressed. The details of the quality control testing are presented in the AGI report.

Twenty asphalt cores were removed for testing and measurements. The average thickness of ten cores was 4.14 inches. The project specifications required an average thickness of 3 inches based on ten cores measured.

Nine cores were tested for density and the average was 96.75 percent. The highest was 98.2 and the lowest was 95.1 percent. The project specification requires 97 percent based on five cores. Five of the nine cores tested were 97 percent or greater. The average compaction measured by the nuclear density gauge was 99.2 percent.

The percent air voids specification of 4 percent maximum was met, with the average tested being 3.25 percent.

Project specifications required the PMA to have a permeability of 1 x 10^{-8} cm/sec. or less. When the asphalt cores were tested, they were all either impermeable or had a permeability of less than 1 x 10^{-8} cm/sec., including the cold joints.

The resilient modulus (M_R) for ten core samples averaged 148,000 pounds per square inch (psi), somewhat less than the 400,000 psi required in the specification. The 400,000 psi value came from previous work not related to this project. During the mix design for the PMA by Dr. Terrel at Oregon State University, twelve trial mix specimens were tested for resilient modulus. The average value was 226,800 psi. The specimens mixed at 7.0 percent asphalt content had M_R's of 217,000 and 243,000 psi, both having higher air voids than the production pavement asphalt has. The Terrel Research report (page 5) indicated that the M_R tests on the production asphalt cores were run at somewhat higher temperatures than the 73 degrrees Fahrenheit as specified, resulting in lower values. The report also states an opinion that "because use of the polymer modified binder results in much stiffer mixtures during high summertime temperatures, the pavement strength and stiffness should be more than adequate for the expected use." The results of the core tests are summarized in the Terrel Research report, Appendix D, dated November 22, 1991.

On November 20, 1991 the installation of the eight lysimeters under the PMA pavement was initiated by CH2M HILL hydrogeologists. The installation was completed on November 22, 1991. The lysimeter installation methodology and materials are described in a November 25, 1991 memorandum from CH2M HILL to Weyerhaeuser. A plan for monitoring and recording the lysimeter data has been prepared and is in Appendix A of this report.

Positive Drainage

During the installation of the lysimeters the drainage of the pavement was observed and appeared to be adequate, except for a couple low areas. The water formed ponds about an inch deep in those areas. The surface will be monitored throughout the winter months for pavement ponding. Areas that show standing water will be marked and the plan is to fill in low areas to make the surface drain next spring. The condition of the asphalt and the low permeability values of the PMA preclude any significant amount of water seeping through the PMA pavement cover. The lysimeters will be periodically monitored for any effects of seepage through the cover.

Summary

It is our opinion that the closure of the No.1 Cell Room Site was completed in substantial conformance with the project specifications and plans. The closure satisfies Ecology's requirement for an infiltration barrier over the site. The project was developed and constructed in a timely manner which allowed the closure to be completed by the agreed order deadline of December 31, 1991.

If you have any questions regarding this report please contact us.

This was an interesting project and we appreciate the opportunity to have been involved.

Sincerely,

CH2M HILL

Stuart H. Brown

Stu Brown, P.E.

Larry Well

Larry Well

Appendix A

Lysimeter Monitoring Plan
Former No. 1 Cell Room

Weyerhaeuser Company
Longview, WA

Prepared by

CH2M HILL, Inc.
December 1991

PDX947.013.51

Lysimeter Monitoring Plan
Former No. 1 Cell Room

Introduction

This document presents the monitoring plan and operation and maintenance procedures for eight suction lysimeters installed beneath the polymer modified asphalt (PMA) cap that covers the area occupied by the former No. 1 Cell Room. The PMA cap was placed over the areas where mercury-contaminated soils were excavated and replaced with clean fill. The location of the lysimeter stations are shown in Figure 1. Installation of the lysimeters was conducted to satisfy Washington Department of Ecology (Ecology) requirements for monitoring the effectiveness of the cap, as required in Agreed Order 91-TCI 102.

The lysimeters are comprised of a porous ceramic cup affixed to 2-inch-diameter, 12-inch long PVC pipe. Two small diameter tubes protrude from the opposite end and extend to ground surface (see Figure 2). One tube serves as the vacuum tube, while the other is used for sample discharge. When placed in the soil, the pores in the lysimeter cup become an extension of the pore space in the soil. Consequently, the water content of the soil and cup become equilibrated at the existing soil-water pressure. A vacuum is applied to the interior of the lysimeter cup, inducing moisture movement into the lysimeter. After a period of time, the moisture that collects inside the lysimeter can be pumped to the surface through the discharge tube.

It is anticipated that the fill soils underlying the cap may have a residual moisture content associated with precipitation that fell during construction of the cap. Thus, initial lysimeter monitoring may reflect this residual moisture content. Assessment of the long-term effectiveness of the PMA cap will be based on whether or not an increase in moisture content from the initial baseline values is observed. Because groundwater levels are high in the vicinity of the cap, it will be necessary to use water level measurements in nearby monitoring wells to evaluate any observed increases in moisture content measured in lysimeters.

The following sections describe lysimeter monitoring frequency and methodology.

Lysimeter Monitoring Schedule and Methodology

Sampling Schedule

The lysimeters will be monitored on a quarterly basis beginning in January 1992. This frequency should be adequate for evaluating the effectiveness of the PMA cap in preventing water from percolating into underlying soils. After the first year of

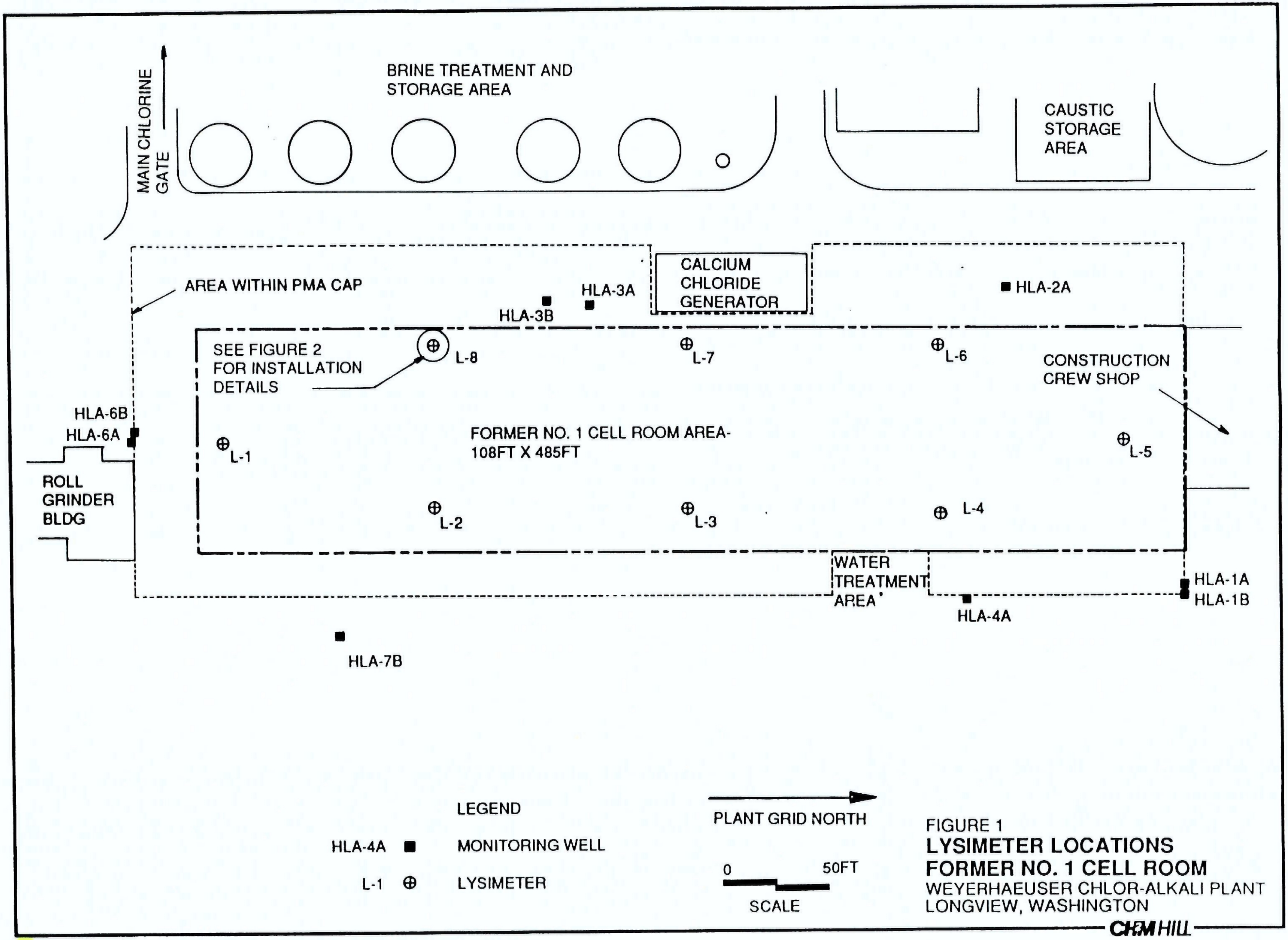


FIGURE 1
LYSIMETER LOCATIONS
FORMER NO. 1 CELL ROOM
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

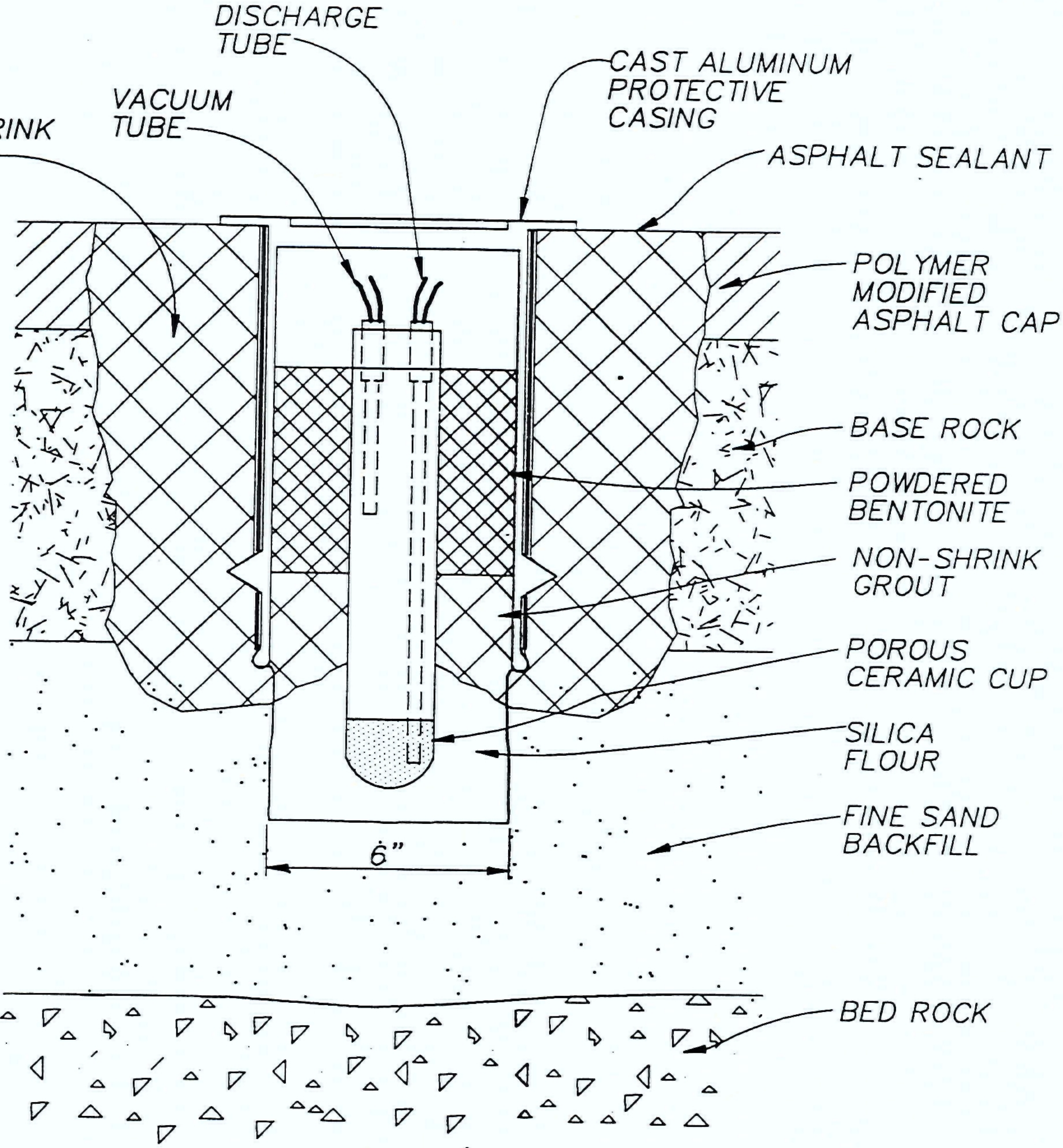


FIGURE 2
SCHEMATIC
LYSIMETER DETAIL
WEYERHAEUSER CHLOR-ALKALI PLANT
LONGVIEW, WASHINGTON

CH2M HILL

monitoring, the data will be reviewed to determine the frequency for long-term monitoring. Water levels in monitoring wells close to the PMA cap (see Figure 1) will be measured at the same time. The water level measurements will be used to assess whether seasonally high groundwater levels are in close proximity to the lysimeters.

Sampling Methodology

Application of Vacuum

A vacuum is applied to the lysimeter to induce moisture movement into the cup. However, before a vacuum is placed on each lysimeter, the following procedures should be followed:

- Remove the well cover lid using a 9/16-inch socket wrench.
- Describe the condition of hole (i.e., dry, wet) and condition of the well cover gasket on data entry sheets. An example is provided in Exhibit 1.
- Examine neoprene tubing (on discharge and vacuum tubes) for cracks or holes. Replace 6-inch pieces as necessary.
- Determine if pinch clamps are usable and replace as needed.
- Read or refer to pressure/vacuum hand pump (PVHP) manual before vacuum application.

Vacuum is applied to each of the eight samplers, beginning with Station L-1, using the following procedure:

- Close the (green) discharge tube with a pinch clamp.
- Connect the special filter tube (described in PVHP manual) to the vacuum outlet on the PVHP. Affix black (vacuum) tube to the filter tube.
- Produce a vacuum of approximately 60 centibars (18 inches of mercury) as read on the pump gauge.
- Clamp the vacuum (black) tube with a pinch clamp to seal lysimeter under a vacuum.
- Place tube ends into plastic bag and reseal sampling station.
- Note date, time, and lysimeter station number.

Once this procedure has been followed for all eight lysimeters. leave the instruments overnight, or for a period of no less than 6 to 8 hours. Exhibit 2 contains a list of materials and equipment that should be brought to the site for each monitoring event.

Sample Collection

The following is the procedure used to obtain water samples from the lysimeter:

- Open the pinch clamps on both discharge (green) and vacuum (black) tubes. Air release should be noticeable.

- Attach the vacuum tube (black) to the pressure port on the hand pump.

- Place the discharge tube (green) into a small collection bottle and apply a few strokes on the hand pump to pressurize the lysimeter and force any water present in the porous cup into the collection bottle.

- Record station number, time, and sample volume, if water is collected.

- Place unclamped tube ends into the plastic bag, clean off the rubber gasket on the protective casing, and tighten the bolts on the lid.

Reporting

Upon completion of each quarterly lysimeter monitoring event, a brief report will be submitted to Ecology, summarizing results. The report will contain copies of the field monitoring forms and a discussion of monitoring results.

Exhibit 1
Data Entry Sheet

Lysimeter Monitoring Summary

Station ID	Date		Time		Sample Volume	Comments
	Vacuum	Sample	Vacuum	Sample		

Exhibit 2
Materials and Equipment List

- Pressure/Vacuum Hand Pump and Manual
- Neoprene tubing (16 feet)
- Pinch clamps
- Sample vials (20)
- Sample labels (10)
- Screwdriver
- Zip-Loc plastic bags
- Rubber bands
- Trowel
- Inner gloves
- Data entry sheets
- Vacuum filter tube
- 9/16" socket and wrench
- Glass beaker
- Graduated cylinder
- Scissors
- Clear adhesive tape
- Steel measuring tape
- Permanent marking pens

Appendix B

No. 1 Cell Room Site Grading and Paving Project Description

Weyerhaeuser Company
Longview, Washington

PDX947/040.51

#1 CELL ROOM SITE GRADING AND PAVING PROJECT DESCRIPTION

9/20/91

SITE DESCRIPTION

The #1 Cell Room Site remains from the demolition of a large building. The 108' x 480' building, built in the mid 1950's was demolished in early 1991. The building itself and some of the soil under it were contaminated with metallic mercury. All demolition debris and hazardous soil were hauled to the Class I landfill at Arlington. The site elevation is approximately two feet below the surrounding grade because of the removal of contaminated soil from under the building.

The estimated total area of the site is 101,280 square feet. The total volume of material that will be required to bring the site up to its finished elevation (including polymer modified asphalt surfacing) is approximately 6200 cubic yards.

The "native" soil remaining on the site averages less than 38 ppm mercury. The "native soil" has been uniformly covered with 4"-6" of clean crushed rock. The plans and specifications for this project do not require any work, excavation or grading below this crushed rock cover.

The "native" soil consists of sand fill hydraulically placed in the early 1950's on the remnant of Mt. Coffin, a basaltic outcrop. The bedrock is between 6" and 48" below the present surface of most of the site. In the extreme north and south of the site the rock drops to 5' to 15' below the surface. In places, 4"-minus crushed rock (used to improve access while the demolition was underway) is mixed into the "native" soil.

OWNER'S OBJECTIVES

The objectives of this project are to fill the site to match the surrounding grade, install catch basins and culverts to drain the site, grade the site to drain to the catch basins, and pave the site. Of particular concern to the Owner are the following:

1. Achievement of specified soil compaction.

2. Durability and impermeability of the drainage grid.

3. Durability and impermeability of asphalt pavement.

4. Positive drainage of all areas within the project site to catch basins without ponding.

PROJECT DRAWINGS

30-15-032-E -- FORMER #1 CELL ROOM AREA GRADE ELEVATIONS rev. 3

30-15-033-E -- FORMER #1 CELL ROOM AREA GRADE & DRAINAGE PLAN rev. 2

30-15-034-E sht 1 OF 2-- FORMER #1 CELL ROOM AREA DETAILS --TRENCH EXTENSION rev. 2

30-15-034-E sht 2 OF 2-- FORMER #1 CELL ROOM AREA DETAILS --BACKFILL, GRADE AND CATCH BASINS rev. 2

30-15-035-E -- FORMER #1 CELL ROOM AREA -- LYSIMETER LOCATIONS rev. 1.

CONSTRUCTION SEQUENCE

The suggested sequence of construction is as follows:

1. Fill (and compact) the site with clean sand to within 12" of the finished grade.

2. Place (and compact) 8" of base rock to within 3" of the finished grade.

3. Install catch basins and culverts. Tie the new drainage grid into the existing concrete trench on the southwest corner of the site.

4. Pave the site with 3" of polymer modified asphalt concrete.

DRAINAGE GRID

Project plans call for the installation of eight shallow catch basins. Piping between the basins is 8" ductile iron water pipe (see below).

The catch basin elevations are such that no excavation of native soil is required to install them.

The drainage grid will terminate at the existing concrete trench at the southwest corner of the site. This existing trench must be modified somewhat to accept the drain pipe.

Following completion of the drainage grid, and before placement of fill above the pipe and catch basins, Owners Representative shall be notified and he will verify that design elevations and slopes have been achieved.

Before paving the site, construction vehicles shall not cross directly over the pipe unless the pipe is first bridged with timbers, soil, etc.

Compaction of material above the pipe zone shall be done with hand compactors only.

For compaction of the asphaltic concrete, only a static (non-vibratory) roller (10 to 12 tons) shall be used over the pipe.

Following completion of the drainage grid installation, and placement of backfill, the water tightness of the installation shall be tested as described in the attached "Water Exfiltration Test Procedure."

DRAINAGE GRID MATERIALS

Drain pipe shall be Ductile Iron Thickness Class 53, "tight-joint" or Owner approved equal.

Catch Basins shall be Pacific International Pipe Enterprises, Inc., (503-285-8391) "Type 22 Curb Inlet" with ductile iron grate and grate frames or Owner approved equal.

Pipe to catch basin connections shall be NPC Inc. "Kor-n-seal I" flexible pipe to manhole connector P/N S106-12 with "Korband" Expander assembly.

SAND BACKFILL

Following completion of the drainage grid, clean sand backfill shall be placed to within 12 inches of the finished "top of asphalt" elevation. Sand backfill shall be placed in 6" lifts and compacted to 95% Modified Proctor ASTM D-1556.

ROCK BASE COURSE

Following completion of the sand backfill, and verification of compaction, 8" of crushed rock base course shall be placed. Rock Base Course shall be placed in 6" lifts and compacted to 95% Modified Proctor ASTM D-1556.

Base course materials, placement and compaction shall conform to **Weyerhaeuser Company Design Standard C-032-S 2.1 "Crushed Aggregate Base Course, Top Course, and Keystone."**

POLYMER MODIFIED ASPHALT

As noted in the Owner's Objectives section above, the impermeability of the asphalt cover is of primary concern. For this reason Polymer Modified Asphalt will be used for paving the Site.

Following placement of the rock base course and verification of compaction, 3" of "ECOMAT" Polymer Modified Asphalt shall be placed to the "Top of Asphalt" elevations. Asphalt materials, placement, and compaction shall conform to **Weyerhaeuser Company Design Standard C-033 S 1.1 "Asphalt Concrete Surfacing,"** modified as described below.

Mix Design Requirements

The actual proportioning of the several components to be used in the production of asphalt concrete mixture shall be determined by the Contractor. The surface mixture shall conform to the guideline specifications for ECOMAT, a proprietary (patent pending) design and materials system for environmental applications. The ECOMAT system is one or more layers of a bituminous concrete with the binder usually consisting of a polymer modified asphalt or other material formulated for specific applications. The use of this system is licensed to paving contractors or other construction specialists by Terrel Research. The contractor is required to provide a mixture design proposal to the Owner's Representative that is an approved ECOMAT design. The contractor is directed to the following for further information:

Dr. Ronald Terrel
Terrel Research
9703 241 Place SW
Edmonds, WA. 98020
(206) 542-9223

Mix Design Test Certificate

Contractor shall furnish the Owner with an independent laboratory test report certifying that the mixture supplied conforms to the above specifications. This report shall be approved by Terrel Research and include Quality Control test results.

General Requirements for ECOMAT

1. For this Project the ECOMAT binder shall be a polymer modified asphalt formulated according to the designation ECOMAT 60 and shown in Figure 1. This material may be obtained in Washington State from Chevron Co. (Richmond Beach) or U.S. Oil and Refinery (Tacoma).

2. Aggregate shall be a crushed glacial gravel (or approved equal) similar to that for Class B asphalt concrete (Section 9-03.8 WSDOT Specifications), except that the gradation will be modified for ECOMAT as described below. The final determination of gradation will be made following the evaluation of laboratory test data, based upon compaction and voids and this gradation will become part of the mix design.

3. Binder (ECOMAT) content will be 6.5 to 9.0 percent by weight, as determined in the mix design.

4. Air voids of the compacted ECOMAT mixture shall be 4 percent or ~~of~~ less, both in laboratory specimens and field compacted mixtures. Actual compaction effort may be adjusted accordingly.

5. Permeability (k) of laboratory compacted specimens (4 inches diameter by 4 inches high) will be 1 x 10^{-8} cm/sec or less as measured by ASTM D3637 or an equivalent procedure (for example SHRP) and approved by Terrel Research.

6. Resilient modulus (M_R) of laboratory compacted specimens (4 inches diameter by 4 inches high) and core samples shall have a minimum value of 400,000 psi when tested at 73

degrees f (pulse load 0.1 sec., 0.9 sec. rest period), by ASTM 4123-87.

Aggregate Gradation

Aggregate gradation for ECOMAT asphalt shall be as follows:

Sieve size	Percent passing
5/8 in.	100
1/2 in.	96-100
3/8 in.	85-95
1/4 in.	60-80
No. 10	36-50
No. 40	12-25
No. 80	7-15
No. 200	5-10
Mineral Filler	0-2
Asphalt (% of total)	6.5-9.0

Samples

Binder and asphalt binder materials proposed for the Project shall be submitted to the Owner's Representative for testing and approval. The following samples will be submitted for testing:

1.	Asphalt cement	4 ea. 1-qt. cans
2.	Aggregate (composite gradation)	3 ea. 5-gal. cans
	or	2 ea. 5-gal. cans of both coarse and fine fractions from stockpiles
3.	Additives (if any)	1 ea. 1-qt. can
4.	Mineral filler (if any)	1 ea. 1-gal. can

When the samples are ready, please contact Ronald Terrel at (206) 542-9223 for shipping instructions.

Field Trials

Before full scale construction, a trial section may be constructed in order to develop an appropriate level of compaction and other procedures for the ECOMAT surface layer. The actual procedure will be developed and directed by the Owner's Representative with the Contractor to assure that an adequate density and roller pattern can be achieved to meet the mixture requirements for ECOMAT asphalt concrete as outlined above. Field density control will be accomplished using suitable calibrated nuclear density devices as approved by the Owner's Representative and conducted by a certified testing laboratory. Core samples will be required to confirm density, void and permeability values (a minimum of 4 pairs = 8 total). Construction of the facility shall not proceed until approved by the Owner's Representative.

Cold Joints

Paving operations shall proceed so that adjacent succeeding passes of the paver occur soon enough to maintain a hot joint. In cases where a cold joint becomes necessary, prior to resuming paving, the existing paving edge shall be thoroughly cleaned with a power broom to remove all debris. Then a tack coat of emulsified asphalt shall be applied using a sprayer or broom. The joint shall then be heated with a propane torch or other suitable heater to a surface temperature of at least 120 degrees F just ahead of the paving machine.

EXISTING GRADES OUTSIDE THE PROJECT AREA

Contractor shall grade and pave the project site to match as closely as possible the existing elevations of the surrounding area. Contractor shall grade around the existing footings, wells, etc. within the project site, not all of which are shown on project drawings.

LYSIMETER INSTALLATION

Eight lysimeters will be installed in the sand backfill as shown on Weyerhaeuser Drawing #30-15-035-E -- FORMER #1 CELL ROOM AREA -- LYSIMETER LOCATIONS. The purpose of the lysimeters is to enable collection of fluids that may be present in the pore spaces in soil surrounding the instrument. The lysimeters will be used to check periodically the effectiveness of the asphalt cap in preventing infiltration of water vertically through the soil.

In order to assure that the lysimeters are not damaged by backfill and paving operations, the lysimeters will be installed following completion of the asphalt concrete paving.

#1 CELL ROOM SITE WATER EXFILTRATION TEST PROCEDURE

Following the completion of the drainage grid and backfill, but before placement of asphalt surfacing, the watertightness of the drainage grid shall be tested as follows:

Plug the 8" diameter outlets of the two catch basins at gridline "G."

Fill the drainage grid north of gridline "G" to the top of the asphalt elevation at gridline "G."

Plug the 8" diameter outlet into the existing concrete trench.

Fill the portion of the drainage grid south of gridline "G" to the top of asphalt elevation at the western catch basin at gridline "I."

The liquid elevation in the catch basins at gridline "G" shall not drop more than 1.5" in 24 hrs.

The liquid elevation in the catch basins south of gridline "G" shall not drop more than 1" in 24 hrs.

Should either test show an exfiltration rate greater than permitted, the Contractor shall, at his expense, locate and repair defective joints or pipe sections. After repairs are completed, the line shall be retested until the exfiltration rate is within the specified allowance.

FIGURE 1 -- ECOMAT POLYMER MODIFIED ASPHALT CONCRETE

This asphalt cement shall be modified by the incorporation of polymer. A minimum of 3.0 wt% shall be polymer. The modified asphalt cement shall conform to the following requirements when tested in accordance with the specified test method.

TEST	METHOD	MIN	MAX
Penetration @ 77 deg. F dmm	AASHTO T49	60	100
Viscosity @ 275 deg F cSt	AASHTO T201	--	1000
Softening point,F	AASHTO T53	130	--
Penetration @39.2 deg F, 200g, 60s dmm	AASHTO T49	27	--
Ductility	AASHTO T51	10	--
Properties after RTFO, (AASHTO T240)			
Penetration Ratio @ 77 deg F, Unaged, Aged	AASHTO T49	--	2.2
Penetration @ 39.2 deg. F 200 g, 60s, dmm	AASHTO T49	17	--
Mass Loss, %	AASHTO T240	--	1.0

NOTE: The modified asphalt cement shall be prepared by blending the polymer into the hot asphalt cement at a refinery ~~of~~ or terminal at temperatures below 375 deg. F. The modified asphalt cement shall be circulated or agitated for a minimum of one hour per day to ensure continued homogeneity. Storage temperature shall not exceed 375 deg. F. If idle periods exceeding 72 hours are experienced, storage temperature shall be reduced to 325 deg. F or below.

Acceptance

The acceptance of the polymer modified asphalt cement will be based upon the manufacturer's certification of compliance which must include:

1. Copies of the test data showing specific compliance.
2. Identification of polymer, and
3. A statement from the polymer supplier certifying that the polymer and asphalt are compatible.

CRUSHED AGGREGATE BASE COURSE, TOP COURSE, AND KEYSTONE

1.0 GENERAL

1.1 Scope

This specification covers the production, placing, compaction, and fine grading of graded crushed aggregate for use as a base course for pavement and building slabs, including crushed aggregate top course and keystone.

1.2 Work Included

The contractor shall furnish all labor, supervision, materials, tools, equipment, transportation and all other items necessary to satisfactorily complete the work outlined in the Scope above, and as defined in this Specification and on the Drawings.

1.3 Work not Included under this Specification

1.2.1 Subgrade preparation.

1.3.2 Subbase and Ballast Construction.

1.3.3 Pavement surfacing or wearing surface.

1.4 Codes & Standards referenced by this Specification

Standard Specification of the State Highway or Transportation Department(s) of the State(s) in which the aggregates will be produced and used.

1.5 Designer Reference (not included in this Specification)

Design Standard C .032 C1.1 Base Course - Application Criteria.

2.0 PRODUCT

Crushed Aggregate Base Course, Top Course and Keystone shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of this Specification. The materials shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material and shall meet the following test requirements:

Los Angeles Wear, 400 Rev.	35% Max.
Degradation Factor - Top Course	25% Min.
Degradation Factor - Base Course	15% Min.

Crushed aggregate shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the construction area, or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be at the construction area.

	Base Course	Top Course and Keystone
% Passing 1-1/4" square sieve	100	
% Passing 5/8" square sieve	50 to 80	100
% Passing 1/4" square sieve	30 to 50	55 to 75
% Passing U.S. No. 40 sieve	3 to 18	8 to 24
% Passing U.S. No. 200 seive	7.5 Max.	10 Max.
Sand equivalent	40 Min.	40 Min.

(All percentages are by weight)

When separated on 1/4", 5/8", 1" and 1-1/4" sieves, crushed aggregate shall contain in each size, including material retained on U.S. No. 10 not less than 75 percent by weight of particles with at least one fractured face produced by mechanical crushing.

The portion of crushed surfacing retained on a 1/4" square sieve shall not contain more than 0.15% wood waste.

3.0 EXECUTION

3.1 Production of Crushed Aggregate from quarry and pit sites shall conform to production, stockpiling, and handling requirements of the standard specification of the State Highway or Transportation Department(s) of the State(s) in which the aggregates are produced and used.

3.2 Stockpiling and Placement

3.2.1 Material stockpiling if required, shall be done in such a manner that segregation of sizes is prevented. Stockpile storage areas on site and off shall be satisfactory to Owner; cleared, drained and leveled. Materials from different sources of strata shall be stockpiled in separate piles. Stockpiling method and areas shall be subject to approval by Owner. Use of bulldozer to move materials will not be permitted.

3.2.2 Crushed aggregate shall not be placed on the prepared subgrade without approval of the Owner.

3.2.3 Crushed aggregate conforming to this Specification shall be placed and spread to a uniform nominal depth not to exceed 0.75' in compacted thickness, unless noted otherwise on the Drawings.

3.2.4 Each layer of the aggregate base shall be shaped essentially to its final elevation profile and thickness prior to compaction.

3.3 Weather Limitations

Base material shall not be placed on subgrade during or immediately after periods of precipitation when subgrade conditions in the opinion of Owner will not provide a satisfactory foundation. Base course placed on the subgrade prior to precipitation shall not be compacted immediately after heavy rainfall, if in the opinion of Owner, compaction of the saturated base is detrimental to the subgrade. The Contractor shall provide adequate pumping or drainage of the subgrade and base course to prevent water from standing in the work areas.

3.4 Compaction Control

3.4.1 A compaction control test shall be performed by the Contractor on an area of 2,000 square feet using aggregate, procedures and equipment which will be used for the installation of aggregate base course. Water shall be added at the direction of the Owner, when required to facilitate spreading and compacting the material to a smooth, tight uniform surface. The Owner shall be the sole judge of the degree of compaction achievable by the Contractor with the specific hauling and compaction units approved for use in this control test.

3.4.2 The Contractor's proposal for the work covered by this Specification shall be based on routing loaded haul equipment across the base course. In addition, his proposal shall provide for three full coverages of a 50-ton vibrating roller over all areas of the base course to achieve the desired degree of compaction. If results of the compaction control test, inclusive of the effect of hauling units, indicate more or less coverages is required for the remainder of the work, an adjustment shall be made in the contract price. An adjustment in the contract price for any required changes in compaction coverage shall be negotiated.

3.4.3 Each layer of the aggregate base shall be compacted as determined by the compaction control test using the same aggregate, compaction equipment and procedures, before the next succeeding layer of base is placed.

3.4.4 The Contractor shall maintain equipment adequate quantity of Owner-approved compaction equipment for maintaining the scheduled progress of the work. Changes in aggregate source, construction procedures, or compaction equipment from that used in the compaction control test will negate the results of the control test. The Owner reserves the right to temporarily suspend further installation of aggregate base at any time when, in the Owner's judgement, adequate compaction is not being achieved.

3.5 Crushed Surfacing Top Course

3.5.1 Where specifically called for on the drawings, the Contractor shall place a top course of crushed surfacing over the compacted aggregate base. The thickness of this top course shall be as shown on the drawings (Max. 4") and shall be included with the total design thickness of the base course unless otherwise noted on the drawings. Top course shall be spread with a spreader box or other means acceptable to the Owner. The 0.1 feet thickness shall be brought to suitable moisture content and compacted into the surface of the aggregate base course. This procedure shall also be used to correct thickness and finish grade deficiencies and finished surface and base course thickness deficiencies, when directed by the Owner.

3.5.2 Where specifically called for on the drawings, crushed surfacing top course shall be used as keystone to key the top surface of the aggregate base. The keystone shall be spread evenly on top of the aggregate base, watered and bladed lightly until the keystone is worked into the interstices, and shall be compacted. The operations of adding keystone, wetting, blading and compacting shall be continued until the course has become thoroughly keyed and compacted.

3.6 The final surface of the aggregate base shall conform to within 0.5 feet of line and to within 0.1 foot of grade as shown on the drawing. In addition, the final surface shall be smooth, tight and uniform, constructed to a tolerance of $\pm 1/2$ inch in 10 feet when checked with a straight-edge.

3.7 The final compact thickness shall average 95 percent of the design thickness indicated on the Drawings based on measurements taken by the Owner at three (3) representative locations in the completed construction. Thickness deficiencies shall be corrected by the Contractor at no adjustment in contract price as prescribed in paragraph 3.5.2 of this Specification. If thickness deficiencies are not corrected to the satisfaction of the Owner, the final price due the Contractor for all work performed under this specification shall be adjusted downward on a direct proportion basis (average actual thickness versus total design thickness), by averaging the sum of the three measurements previously taken, plus the sum of three additional measurements taken by the Owner at representative locations selected by the Contractor. No additional compensation will be awarded the Contractor due to "shrinkage" claimed between truck or weight-measure and final averaged in-place measure.

3.8 Inspection

The Owner will provide an inspector for control of this work.

ASPHALT CONCRETE SURFACING

1.0 GENERAL

1.1 Scope

This specification covers furnishing, spreading and compacting asphalt concrete surfacing, on a prepared foundation or base in conformity with lines, grades, thicknesses, and typical cross-sections shown on the Drawings.

1.2 Work Included

The Contractor shall furnish all labor, materials, tools, equipment, transportation and all other items necessary to complete the work outlined in scope above and as defined in these Specifications and on the Drawings.

1.3 Related Work Not Included

1.3.1 Foundation, stabilized soil, aggregate base and subbase.

1.3.2 Asphalt treated base (ATB).

1.3.3 Striping and marking.

1.3.4 Asphalt curbs.

1.4 Codes and Standards referenced by this Specification:

- Standard Specification of the State Highway or Transportation Department(s) of the State(s) in which the asphalt concrete surfacing is produced and placed.

- American Society for Testing and Materials:

  ASTM D 977-73 Emulsified Asphalt.

  ASTM D 995-75 Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

  ASTM D 1188-71 Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.

  ASTM D ~~1599~~ 1559-75 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

1.0 GENERAL (Cont'd)

1.4 Codes and Standards (Cont'd)

ASTM D 2027-72 Liquid Asphalt (Medium Curing Type).

ASTM D 2397-73 Cationic Emulsified Asphalt.

ASTM D 2489-67 Degree of Particle Coating of Bituminous-Aggregate Mixtures.

- AASHTO American Association of State Highway and Transportation Officials, latest edition:

AASHTO M17, M226, M83, M140, M208 and T-195.

1.5 Designer Reference (Not included in this specification).

Design Standard C-033 C 1.1 Pavement Criteria

2.0 PRODUCT

2.1 The Supplier's Plant which will produce the asphalt concrete surface mixture shall be certified by the National Asphalt Pavement Association, or shall otherwise submit evidence of compliance with the Requirements for Mixing Plants for Hot-Mixed, Hot-Laid, Bituminous Paving Mixtures, ASTM D 995.

2.2 Asphalt Concrete Surfacing - Defined

Asphalt Concrete Surfacing consists of one or more courses of plant mixed asphalt concrete placed on a prepared foundation or base. Asphalt concrete surfacing is designated herein as Class B, D, E, F, and G. Asphalt concrete shall be composed of asphalt and aggregate which, with or without the addition of mineral filler and blending sand as may be required, shall be mixed in the proportions specified to provide a homogeneous, stable and workable mixture. The uppermost course of asphalt concrete surfacing is designated the wearing course.

2.3 Materials

2.3.1 Asphalt cement shall be paving Asphalt AR-4000W as set forth in the Uniform Pacific Coast Specifications for Viscosity Graded Paving Asphalts. (These requirements are identical to AASHTO Grade AR-40, per table 3 of AASHTO standard M226.) Paving Asphalt shall have the following characteristics:

2.0 PRODUCT (Cont'd)

2.3 Materials (Cont'd)

2.3.1 (Cont'd)

Tests on Residue from RTFC Procedure - Calif. Method 346 (1)

Absolute Viscosity at 140°F, poise	2500-5000
Kinematic Viscosity at 275°F, cs, min.	275
Penetration at 77°F, 100g/5 sec., min.	40
Percent of original penetration at 77°F, min.	45
Ductility at 45°F, (1 cm/min.), cm, min.	10

Test on Original Asphalt

Flashpoint (Cleveland Open Cup)°F, min.	440
Solubility in Trichloroethylene, percent min.	99

TFO may be used but RTFC shall be the preferred method.

Paving asphalt shall be free from water and shall not foam when heated to 350°F.

2.3.2 Aggregates for Asphalt Concrete shall be manufactured from ledge rock, talus, or gravel, in accordance with the provisions of this Specification. The material from which they are produced shall meet the following test requirements:

Los Angeles Wear, 500 Rev.	30% Max.
Degradation Factor - Wearing Course	15 Min.
- Other Courses	20 Min.

Aggregate shall be uniform in quality, substantially free from wood, roots, bark, extraneous materials and adherent coatings. The presence of a thin, firmly adhering film of weathered rock will not be considered as coating unless it exists on more than 50 percent of the surface area of any size between consecutive laboratory sieves.

Mineral aggregate removed from deposits contaminated with various types of wood waste shall be washed, processed, selected or otherwise treated to remove sufficient wood waste so that the ovendried material retained on a 1/4-inch square sieve shall not contain more than 0.1% by weight of material with a specific gravity less than 1.0.

In addition, aggregate for asphalt concrete shall meet the following test requirements:

2.0 PRODUCT (Cont'd)

2.3 Material (Cont'd)

2.3.2 (Cont'd)

Class of Asphalt Concrete		B	D	E	F	G
Fracture, each size above U.S.No. 10	% Min.	75	75	50	50	75
Sand Equivalent	Min.	45	45	45	35	45

For asphalt concrete Class B, the aggregate shall meet the fracture requirement for the following sizes, 1/2" to 3/8", 3/8" to 1/4" and 1/4" to #10.

The fracture and sand equivalent requirements shall apply to the aggregate material at the time of its introduction to the cold feed of the mixing plants. Deficiencies in sand equivalent shall be corrected by the use of blending sand, provided, however, that the aggregate in the final mix meet pertinent fracture and grading requirements.

Blending sand shall be clean, hard, sound material, either naturally occurring sand or cursher fines, and must be material which will readily accept an asphalt coating. Blending sand shall have a minimum sand equivalent of 30.

Blending sand shall be tested for conformance by an independent testing laboratory before it will be approved for use.

Mineral filler shall conform to the requirement of AASHTO Designation M-17 and in addition shall have a specific gravity of not less than 2.50.

2.3.3 Proportions of Materials

The materials of which asphalt concrete is composed shall be of such sizes, gradings, and quantities that, when proportioned and mixed together, they will produce a well graded mixture within the requirements listed in the table which follows.

The percentages of aggregate include mineral filler, when used, and refer to the complete dry mix. The percentages of asphalt refer to the complete asphalt concrete mixture. All percentages are by weight.

GRADING AND ASPHALT REQUIREMENTS

Percentages by Weight Passing Sieves

	Class B	Class D	Class E	Class F	Class G
1-1/4" sieve (square opening)			100		
1" sieve (square opening)			90-100		
3/4" sieve (square opening)				100	
5/8" sieve (square opening)	100		67- 86		
1/2" sieve (square opening)	90-100	100	60- 80		
3/8" sieve (square opening)	75- 90	90-100			97-100
1/4" sieve (square opening)	55- 75	54- 72	40- 62	45- 78	60- 88
U.S. No. 10 sieve	32- 48	12- 28	25- 40	30- 50	32- 53
U.S. No. 40 sieve	11- 24	0- 10	10- 23		11- 24
U.S. No. 80 sieve	6- 15		6- 14		6- 15
U.S. No. 200 sieve	3- 7	0- 3	2- 9	2- 8	3- 7
Mineral Filler	0- 2				0- 2
Asphalt % of total mixture	4.0-7.5	4- 6	3.5- 7	4- 7	4- 7.5

2.0 PRODUCT (Cont'd)

2.3 Materials (Cont'd)

2.3.3 Proportion of Materials (Cont'd)

The sand/silt ratio for class B and class G asphalt concrete shall be 8 ± 2.

Aggregate gradings within the above ranges shall be such that there will be a minimum of 2% of the total aggregate retained between any successive pair of sieves finer than the U.S. No. 10. The gradings shall be of such uniformity that the fractions of aggregate passing the 1/4" and No. 10 sieves during the day's run will conform to the following limitations:

Maximum variation of material passing 1/4" sieve	10%
Maximum variation of material passing U.S. No. 10 sieve	8%

2.3.4 Mix Design and Test Certificate

The actual proportions of the several components to be used in the production of asphalt concrete mixture shall be determined by the Contractor.

When the aggregates are combined within the limits set forth above, and mixed in the laboratory with the designated grade of asphalt, the mixture shall be capable of meeting the following test values:

Class of Asphalt Concrete		B	E	F	G
Stabilometer Value	Min.	30	25	25	30
Cohesiometer Value	Min.	100	100	50	100
% Air voids		2-4.5	2-4.5	2-4.5	2-4.5
Modified Immersion Compression Test-Retained Strength	%Min.	70	70	70	70

The Contractor shall furnish the Owner an independent laboratory test report 30 days after award of the contract, certifying that the mixture supplied conforms to the above Specifications.

2.0 PRODUCT (Cont'd)

2.3 Materials (Cont'd)

2.3.5 Heating and Mixing of Asphalt Material and Aggregate

The asphalt shall be heated to a maximum of 350 degrees Fahrenheit. The asphalt shall be heated in a manner that will avoid local overheating and provide a continuous supply of asphalt material to the mixer at a uniform temperature.

Prepared aggregates shall be heated, then mixed with the asphalt materials sufficient to produce 95% coated particles as determined by test method AASHTO T-195 or ASTM D 2489.

When discharged, the temperature of the mix shall not exceed 300°F. A maximum water content of two percent (2%) in the mix, at discharge, will be allowed providing the water causes no problems with handling, stripping, or flushing.

2.3.6 Cut-back asphalt for prime coat, if required by notation on the Drawings, shall be MC-30, MC-70, or MC-250 complying with requirements of ASTM D 2027 (AASHTO M83).

2.3.7 Emulsified asphalt for tack coat, if required by notation on the Drawings, shall be SS-1, SS-1h, CSS-1 or CSS-1h, (see ASTM D-977), diluted one part water to one part emulsified asphalt. Before dilution, the emulsified asphalt shall comply with the requirements of ASTM D977 or D2397 (AASHTO Specification M140 or M208).

2.3.8 Soil Sterilant shall be a borate-chlorate type containing not less than 25% sodium chlorate. It shall be mixed thoroughly with water at the rate of 1.5 pounds of sterilant per gallon of water.

2.3.9 Other Materials to be furnished by the Contractor, if any, shall be as noted on the Drawings.

3.0 EXECUTION

3.1 Construction Layout

The prepared subgrade shall be presumed at its proper elevation, unless exceptions are furnished the Contractor

3.0 EXECUTION (Cont'd)

3.1 Construction Layout (Cont'd)

in writing by the Owner prior to award of the Contract. The Contractor shall provide all layout control of the work covered by this Specification including line, grade where necessary, and thickness control.

3.2 Soil Sterilization, when required, will be noted on the Drawings. The specified sterilant shall be applied uniformly at the rate of 0.2 gallons per square yard to those areas designated on the Drawing. The Contractor shall take whatever precautions are necessary to prevent contamination of adjacent soil areas and protection of personnel. The Contractor shall correct any damage to adjacent soil areas to the satisfaction of the Owner.

3.3 Preparation of Aggregate Base Surfaces

The existing pavement base shall be proof rolled by the Contractor prior to placing any materials thereon. Exceptions, if any, in acceptability of the base of the Contractor for construction of the asphalt concrete surfacing, shall be made in writing and immediately given to the Owner. The Owner will initiate whatever corrective measures are necessary within 24 hours after receipt of such written notification.

Deficiencies, if any, will be corrected by the Contractor to the satisfaction of the Owner as he may direct, prior to directing the Contractor to proceed with construction.

The texture of the prepared surface of the pavement base shall be presumed by the Contractor to be open-graded with considerable surface interstice voids, consistent with the base materials indicated on the Drawings. The Contractor's proposal shall include the cost of any supplemental surface preparation work he may choose to do, which will be subject to Owner approval. For example, keystone to fill the interstices may be provided by the Contractor where such stone is not indicated on the Drawings as part of the base course construction. However, supplemental surface preparation work to minimize the volume of asphaltic concrete to be furnished is not required by this specification.

A prime coat will be required only if specifically called for on the Drawings. When called for, cut-back asphalt as specified herein shall be applied uniformly at the rate of from 0.20 to 0.50 gallons per square yard. Any ponding of asphalt due to overapplication and lack of absorption shall be completely blotted with sand prior to spreading and compacting the overlying asphalt concrete.

3.0 EXECUTION (Cont'd)

3.4 Preparation of Asphalt, Concrete or Brick Surface

Before construction of an asphalt concrete pavement on an existing surface, all fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed by the Contractor from the existing pavement. All excess asphalt joint filler shall be completely removed and all premolded joint filler shall be removed to at least one-half inch (1/2") below the surface of the existing pavement. All types of existing pavement or bituminous surfaces shall be thoroughly cleaned by sweeping to removed dust and other foreign matter.

A tack coat of asphalt applied at the rate of 0.02 to 0.08 gallon per square yard of retained asphalt shall be applied through the use of approved mechanical equipment to all surfaces on which any course of asphalt concrete is to be of uniformly distributing asphalt materials over any area in controlled amounts and shall be equipped with hand operated spray equipment for use only on inaccessible and irregularly shaped areas.

When asphalt concrete pavement is to be constructed over an existing paved or oiled surface, in addition to the preparation as outlined herein, all holes and small depressions shall be filed with an appropriate class of asphalt concrete mix. The surface of the patched area shall be leveled and compacted thoroughly.

When the surface of the existing pavement or old base is irregular, it shall be brought to uniform grade and cross section as indicated on the Drawings.

Preleveling of uneven or broken surfaces over which asphalt concrete is to be placed is required and may be accomplished by the use of an asphalt concrete (of class included in the project) placed with a motor patrol grader, a paving machine, by hand raking, or by a combination of these methods as directed by the Owner.

After placement, the asphalt concrete used for preleveling shall be compacted thoroughly with pneumatic-tired rollers.

3.5 Spreading and Finishing

The mixture shall be laid upon an approved surface, spread and struck off to the thickness and in conformance with the grade and cross section shown on the Drawings.

3.5 Spreading and Finishing (Cont'd)

Asphalt pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable. Unless otherwise directed by the Owner or specified on the Drawings, the nominal compacted depth of any layer of any course shall not exceed the following depths:

Asphalt Concrete Class E	0.35 foot
Asphalt Concrete Class B when used for Base Course	0.35 foot
Asphalt Concrete Class B, F and G	0.25 foot
Asphalt Concrete Class D	0.28 foot

The longitudinal joint in one layer shall offset that in the layer immediately below by not more than 6 inches nor less than 2 inches; however, the joint in the top layer shall be at the centerline of any roadway where practical.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the paving may be done with other equipment or by hand.

The temperature of the mixture at the time it is spread into final position shall be a minimum of 200° Fahrenheit.

3.6 Compaction and Compaction Control

3.6.1 A Compaction Control Test shall be performed by the Contractor during the initial installation of asphalt concrete. The test section shall be one lane in width, 300 feet in length and marked out in 100-foot segments. The compaction shall proceed so that a total of 4, 8 and 12 passes of the compaction equipment will be applied to the full width of the respective segments. Subsequent test sections and procedures may be modified where considered appropriate by the Owner. A single coverage of the steel wheel roller over the entire area shall complete the compaction process in the test section. Mix temperature variation during compaction will be considered in evaluating the test. Pending test results, paving operations may proceed beyond the test section when authorized by the Owner, using a compactive effort selected from the above procedure.

3.0 EXECUTION (Cont'd)

3.6 Compaction and Compaction Control (Cont'd)

A test section shall be constructed at the start of each layer and repeated as ordered by the Owner whenever: 1) the results of previous tests are not considered by the Owner to be reliable, 2) there is a change in mix composition, 3) there is a change in compaction equipment and 4) routine tests indicate changes from results found in previous qualifying test sections. If necessary, the mix design shall be altered to achieve desired results.

3.6.2 Density Requirements

Acceptance of the compacted pavement with respect to density will be based on the average of five density determinations taken at the descretion of the Owner from each lot of asphalt mixture placed. Cores drilled for the surface course will be used to test the density of the pavement by either ASTM Method of Test D 1188 or ASTM Method of Test D 2726, whichever is applicable. Each lot of the compacted surface will be accepted when the average of the five density determinations is equal to or greater than 97 percent, and when no individual determination is lower than 95 percent, of the average density of the six laboratory-prepared specimens.

A lot will be equal to one day's production. Less than a half day's production will not be considered a lot, but will be added to the immediately preceding lot. The location of sampling sites within a lot's placement area will be chosen on a random basis by the Owner.

3.6.3 Rollers shall be of the steel wheel, vibratory, or pneumatic tire type and shall be in good condition, capable of reversing without backlash, and shall be operated at speed slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment which results in excessive crushing of the aggregate will not be permitted. Rollers producing pickup, washboard, uneven compaction of surface or other undesirable results shall be rejected by the Owner.

3.0 EXECUTION (Cont'd)

3.6 Compaction and Compaction Control (Cont'd)

3.6.3 (Cont'd)

All rollers shall be operated in the same manner while compacting the asphalt mixture as used on the test section.

Vibratory rollers shall meet the following specifications:

1. A variable amplitude will be required, with at lease 2 settings.

2. A variable frequency that operates at or above 2,000 VPM.

3. The maximum rate of travel under vibration shall be limited to 3 MPH.

4. Pneumatic tires on surface courses shall be limited to smooth tires which will not leave visible tracks.

3.6.4 Compaction

Immediately after the asphalt concrete mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted so that all portions of the mat receive adequate compression. The surface shall be compacted when the mixture is in the proper condition and when the compacting process does not cause undue displacement, cracking or shoving. All compaction units shall be operated at the speed that will produce the most effective densification. Areas inaccessible to large compaction equipment shall be compacted by mechanical or hand tampers. Any asphalt concrete that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective, shall be removed and replaced at no additional cost with fresh hot mix which shall be immediately compacted to conform with the surrounding area. The completed course shall be free from ridges, ruts, humps, depressions, objectionable marks or irregularities and in reasonable conformance with line, grade, and cross section as shown on the Drawings or as established by the Owner.

3.0 EXECUTION (Cont'd)

3.6 A Tack Coat applied to a preceding course of compacted asphalt mixture, will be required only is specifically called for on the Drawings. The application and equipment shall be as outlined in Section 3.4.

3.7 Unfavorable Weather

Asphalt shall not be applied to wet material without approval of the Owner, nor applied during rainfall, sand or dust storms, or any imminent storms that might damage the construction.

Surface Temperature Limitations

Compacted Thickness	Surface Course	Subsurface Course
Less than .1	55°F	55°F
.2	45°F	35°F
.35	34°F	35°F
Greater than .35	D.N.A.	25°F

3.8 Finished Surfaces

The final layer of the asphalt concrete section, whether constructed in one or more courses or over a protective layer, shall not deviate at any point more than 3/8 inch from the bottom of a 10 foot straightedge laid in any direction on the surface of area paving, nor more than 3/16" from the bottom of a 10 foot straightedge parallel to the centerline of all roadways. Failure to meet this requirement will necessitate sufficient surface correction to satisfy the requirement at the Contractor's expense.

3.9 Testing and Inspection for Final Payment

3.9.1 The Owner will provide an inspector for control of this work. Certified test reports and Certificate of Compliance specified herein, shall be furnished by the Contractor.

3.9.2 Target density requirements for each layer of asphalt concrete will be determined by the Owner by taking, for each lot, the average density of six laboratory-prepared specimens representing two subsamples, approximately 22 pounds each, chosen on a random basis, taken from trucks delivering mixture to the job site. By quartering, each subsample will be reduced to obtain three sample units, each of sufficient weight, approximately 2.5 pounds (1.2 kg), to prepare a specimen

3.9 Testing and Inspection for Final Payment (Cont'd)

3.9.2 (Cont'd)

approximately 2-1/2 in (64 mm) in height. The specimens will be compacted in accordance with ASTM Standard Method of Test D 1559, Section 3.5, Compaction of Specimens.

3.9.3 The same cores used to test the density will be used to measure the thickness of the pavement. The compacted surface course shall have average thicknesses no less than that specified on the Drawings. Any definciency in base thickness shall be made up with surface mixture when practicable. Otherwise, the final price due the Contractor for all work covered by this Specification will be adjusted downward by the Owner on the following basis:

A maximum of 10-cores selected at random locations under subparagraph 3.6.2 of these Specifications will be averaged with a maximum of 10-cores selected at random locations by the Contractor. The cost of this sampling and measurement will be borne by the Owner and will be made under his direct supervision. The Contractor may take additional representative core samples at his own expense, when witnessed and measured by the Owner. The Contractor shall include the cost of patching of all core holes in his proposal. In the event final average thicknesses of the surfacing, as determined by averaging all core samples taken, is less than 95% of the respective thicknesses called for on the Drawings, the final price due the Contractor for all work covered at the ratio of actual average compacted thicknesses vs. minimum thicknesses called for on the Drawings.

Appendix C

Summary of Quality Control Services During Construction
by
Applied Geotechnical, Inc.
Portland, Oregon
for
Former No. 1 Cell Room Site

Weyerhaeuser Company
Longview, Washington

PDX947/040.51

A Report Prepared for:

Mr. Ron Kampe
Kampe Associates Inc.
3681 S.W. Carman Drive
Lake Oswego, OR 97035

SUMMARY OF QUALITY CONTROL SERVICES
#1 CELL ROOM SITE GRADING AND PAVING
WEYERHAEUSER - LONGVIEW, WASHINGTON

AGI Job # 1263.02

Applied Geotechnology Inc.
2510 SW First Avenue
Portland, Oregon 97201

November 12, 1991

Applied Geotechnology Inc.

November 11, 1991 1263.02

Mr. Ron Kampe
Kampe Associates Inc.
3681 S.W. Carman Drive
Lake Oswego, OR 97035

SUMMARY OF QUALITY CONTROL SERVICES DURING CONSTRUCTION
#1 CELL ROOM SITE GRADING AND PAVING
WEYERHAEUSER - LONGVIEW, WASHINGTON

Dear Ron:

As requested, presented herein is summary of the geotechnical and pavement quality control services performed for the above-referenced project. The principle findings of our work is summarized below. Supporting field and laboratory data are presented in the Appendices.

- The placement of import sand fill and base rock was observed and tested by representatives from this office between October 9 and October 21, 1991. Numerous nuclear field density tests were performed on the import fill material. Based on the testing and observations, it is our opinion that the import fill materials were placed in accordance with the specifications (i.e., compaction to 95% of the modified Proctor maximum density). Please refer to our daily field memoranda for details.

- Test panels of polymer-modified asphaltic concrete were constructed at the site on October 23, 1991. Test measurements and core results for the test panels were presented in our Technical Memorandum dated October 25, 1991. This information is reproduced in Appendix A for your reference.

- Four Rice determinations from samples recovered during the production paving found theoretical maximum densities of 155.4, 154.5, 155.5 and 154.9 pcf. An average Rice maximum density of 155.1 pcf was used to compute the relative percent compaction. Rice maximum density laboratory determinations are presented in Appendix B.

2510 S.W. First Avenue Portland, OR 97201 FAX 503/222-0141 Telephone 503/222-2820

- Continuous observation and testing with a nuclear density gauge was performed during the production paving on October 29, 1991. Temperatures of the asphalt were found to range from 250 to 325 degrees with an average of approximately 296 degrees. 107 nuclear density tests were performed at 50 to 100-foot intervals as paving progressed.

- Field density testing with the nuclear gauge indicated compaction of the asphalt ranged from 93.1% to 104% of the average Rice maximum density. The average compaction (average of 107 nuclear densiometer tests) was 99.2%. Core test results (see below) indicate the nuclear density test values are 2.3 percent high on average. Field density testing locations are presented on Figure 1. Field memorandum for the production paving along with nuclear density test data sheets are presented in Appendix C.

- 20 cores (10 sets of 2 each) were recovered from the site on November 1st. Core locations were approved prior to coring and are presented on Figure 2.

- Core thicknesses ranged from 3.34 inches to 4.90 inches and averaged 4.14 inches.

- Based on a the saturated surface dry (SSD) bulk specific gravity (G_s), compaction of the core specimens ranged from 95.1% to 98.2% and averaged 96.7% (average of 9 tests).

- Results of the coring (core thickness, specific gravity determinations, and compaction) are summarized in Appendix D. Nuclear density tests were also performed at all core locations (prior to coring) for comparison and this information is included in Appendix D.

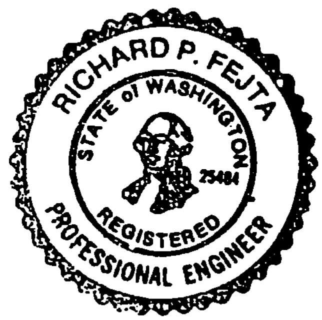
- Permeability and Resilient Modulus testing of the production cores was performed by Terrel Research. Test results are summarized in Appendix E.

- All core locations (including the test pavement cores) were patched as recommended by the pavement designers using a non-shrink grout (CONBEXTRA S).

We trust this information is sufficient for your needs. If you have any questions, please call.

Very truly yours,

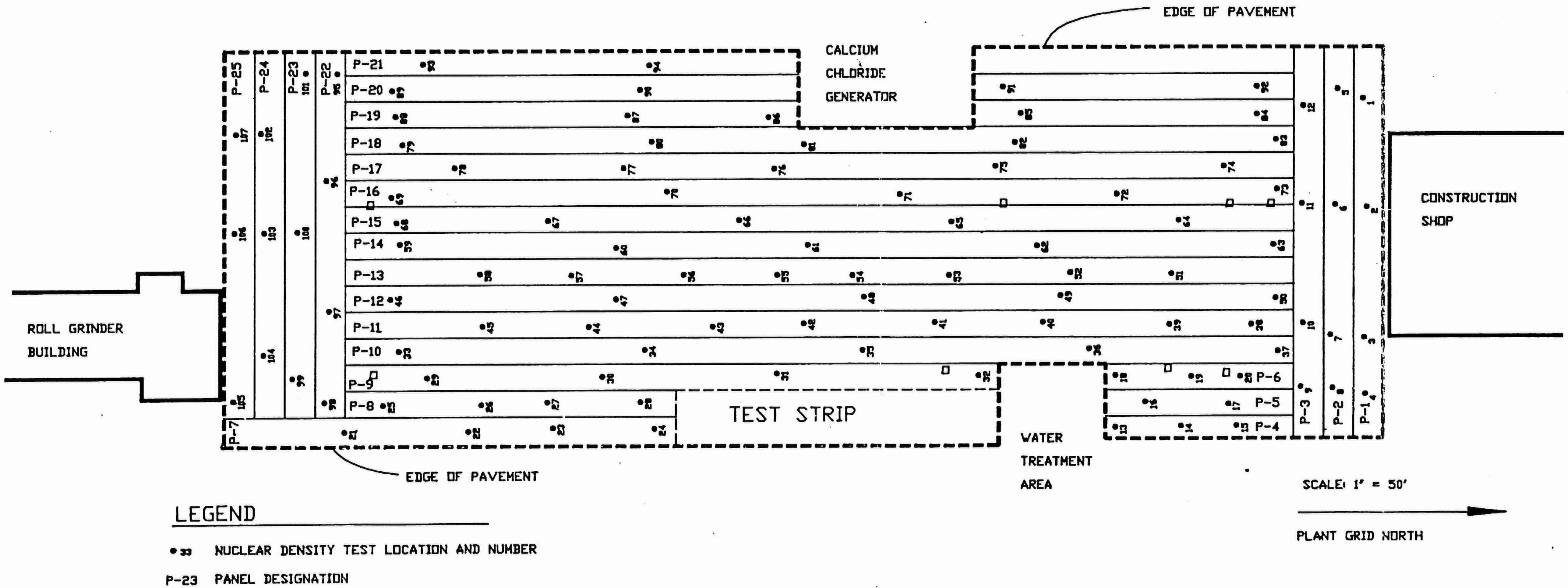
Applied Geotechnology Inc.



Richard P. Fejta

Richard P. Fejta, P.E.

RPF:bm



Base Map: Weyerhaeuser (Columbia Consulting Team) drawing 30-15-036e, dated 9/27/91

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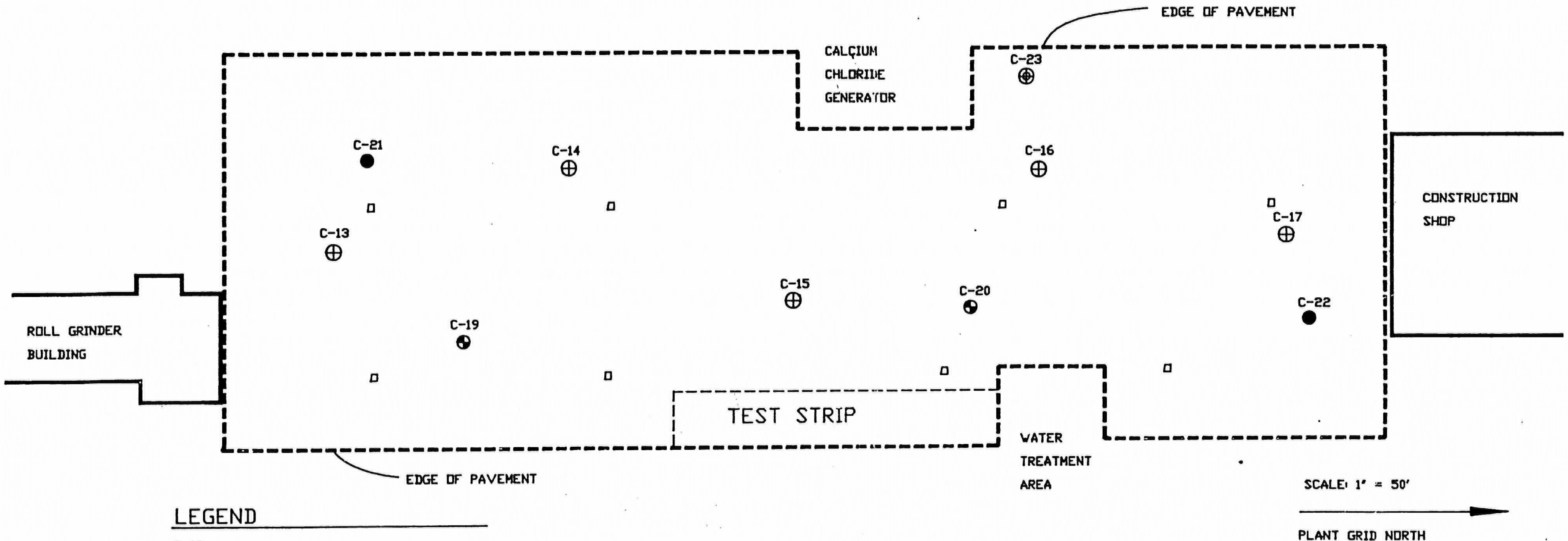
Geotechnical Engineering
Geology & Hydrogeology

NUCLEAR DENSITY TEST LOCATION PLAN
Cell Site Paving
Longview, Washington

FIGURE **1**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
1263.02	CMP		10/31/91		



LEGEND

C-13 ⊕ CORE SET SELECTED BY RANDOM NUMBER TABLE

C-19 CORE SET AT HOT JOINT

C-21 ● CORE SET IN COLD JOINT

C-23 CORE SET IN HAND COMPACTED AREA

Base Map: Weyerhaeuser (Columbia Consulting Team) drawing 30-15-036E, dated 9/27/91

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

CORE LOCATION PLAN
Cell Site Paving
Longview, Washington

FIGURE **2**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
1263.02	CMP		10/31/91		

Applied Geotechnology Inc.

A Report Prepared for:

Mr. Ron Kampe
Kampe Associates Inc.
3681 S.W. Carman Drive
Lake Oswego, OR 97035

SUMMARY OF QUALITY CONTROL SERVICES
#1 CELL ROOM SITE GRADING AND PAVING
WEYERHAEUSER - LONGVIEW, WASHINGTON

AGI Job # 1263.02

Applied Geotechnology Inc.
2510 SW First Avenue
Portland, Oregon 97201

November 12, 1991

Applied Geotechnology Inc.

November 11, 1991 1263.02

Mr. Ron Kampe
Kampe Associates Inc.
3681 S.W. Carman Drive
Lake Oswego, OR 97035

SUMMARY OF QUALITY CONTROL SERVICES DURING CONSTRUCTION
#1 CELL ROOM SITE GRADING AND PAVING
WEYERHAEUSER - LONGVIEW, WASHINGTON

Dear Ron:

As requested, presented herein is summary of the geotechnical and pavement quality control services performed for the above-referenced project. The principle findings of our work is summarized below. Supporting field and laboratory data are presented in the Appendices.

- The placement of import sand fill and base rock was observed and tested by representatives from this office between October 9 and October 21, 1991. Numerous nuclear field density tests were performed on the import fill material. Based on the testing and observations, it is our opinion that the import fill materials were placed in accordance with the specifications (i.e., compaction to 95% of the modified Proctor maximum density). Please refer to our daily field memoranda for details.

- Test panels of polymer-modified asphaltic concrete were constructed at the site on October 23, 1991. Test measurements and core results for the test panels were presented in our Technical Memorandum dated October 25, 1991. This information is reproduced in Appendix A for your reference.

- Four Rice determinations from samples recovered during the production paving found theoretical maximum densities of 155.4, 154.5, 155.5 and 154.9 pcf. An average Rice maximum density of 155.1 pcf was used to compute the relative percent compaction. Rice maximum density laboratory determinations are presented in Appendix B.

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- Continuous observation and testing with a nuclear density gauge was performed during the production paving on October 29, 1991. Temperatures of the asphalt were found to range from 250 to 325 degrees with an average of approximately 296 degrees. 107 nuclear density tests were performed at 50 to 100-foot intervals as paving progressed.

- Field density testing with the nuclear gauge indicated compaction of the asphalt ranged from 93.1% to 104% of the average Rice maximum density. The average compaction (average of 107 nuclear densiometer tests) was 99.2%. Core test results (see below) indicate the nuclear density test values are 2.3 percent high on average. Field density testing locations are presented on Figure 1. Field memorandum for the production paving along with nuclear density test data sheets are presented in Appendix C.

- 20 cores (10 sets of 2 each) were recovered from the site on November 1st. Core locations were approved prior to coring and are presented on Figure 2.

- Core thicknesses ranged from 3.34 inches to 4.90 inches and averaged 4.14 inches.

- Based on a the saturated surface dry (SSD) bulk specific gravity (G_s), compaction of the core specimens ranged from 95.1% to 98.2% and averaged 96.7% (average of 9 tests).

- Results of the coring (core thickness, specific gravity determinations, and compaction) are summarized in Appendix D. Nuclear density tests were also performed at all core locations (prior to coring) for comparison and this information is included in Appendix D.

- Permeability and Resilient Modulus testing of the production cores was performed by Terrel Research. Test results are summarized in Appendix E.

- All core locations (including the test pavement cores) were patched as recommended by the pavement designers using a non-shrink grout (CONBEXTRA S).

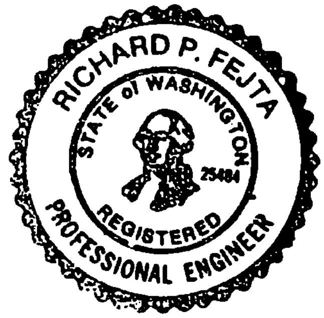
We trust this information is sufficient for your needs. If you have any questions, please call.

Very truly yours,

Applied Geotechnology Inc.

Richard P. Fejta

Richard P. Fejta, P.E.



RPF:bm

Appendix A of Applied Geotechnology, Inc. Document

Applied Geotechnology Inc.

TECHNICAL MEMORANDUM 1263.02

To: Ron Kampe
Paul Seamons
Ron Terrel

From: Richard Fejta, P.E.

Date: October 25, 1991

Re: Weyerhaeuser Site Capping
Results of Test Paving

- Twelve cores of the test panels were recovered from the site on October 24th. Core locations are presented on Figure 1.

- Core thicknesses ranged from 3.17 inches to 4.24 inches and averaged 3.71 inches.

- Two Rice determinations found theoretical maximum densities of 156.9 pcf and 157.6 pcf. An average Rice maximum density of 157.2 pcf was used to compute the relative percent compaction.

- Based on a the saturated surface dry (SSD) bulk specific gravity (G_s), compaction of the core specimens ranged from 93.9% to 97.2% and averaged 95.2%. Typically, compaction levels increased with increasing compactive effort on the west panel. Interestingly, compaction was not adversely affected by the wet area. In fact, compaction in the wet area was the highest (as measured by the cores and the nuclear density gauge) of all places on the test panels.

- Based on the nuclear density gauge backscatter readings at the core locations, compaction ranged from 93.3% to 100% and averaged 96.4%, suggesting that the backscatter nuclear density tests, on average, read about 1% high. Direct transmission tests within the core holes using a 4-inch probe depth ranged from 92.6% to 97.0% and averaged 94.4%

- Results of the core and nuclear density tests are summarized on the attached data sheet.

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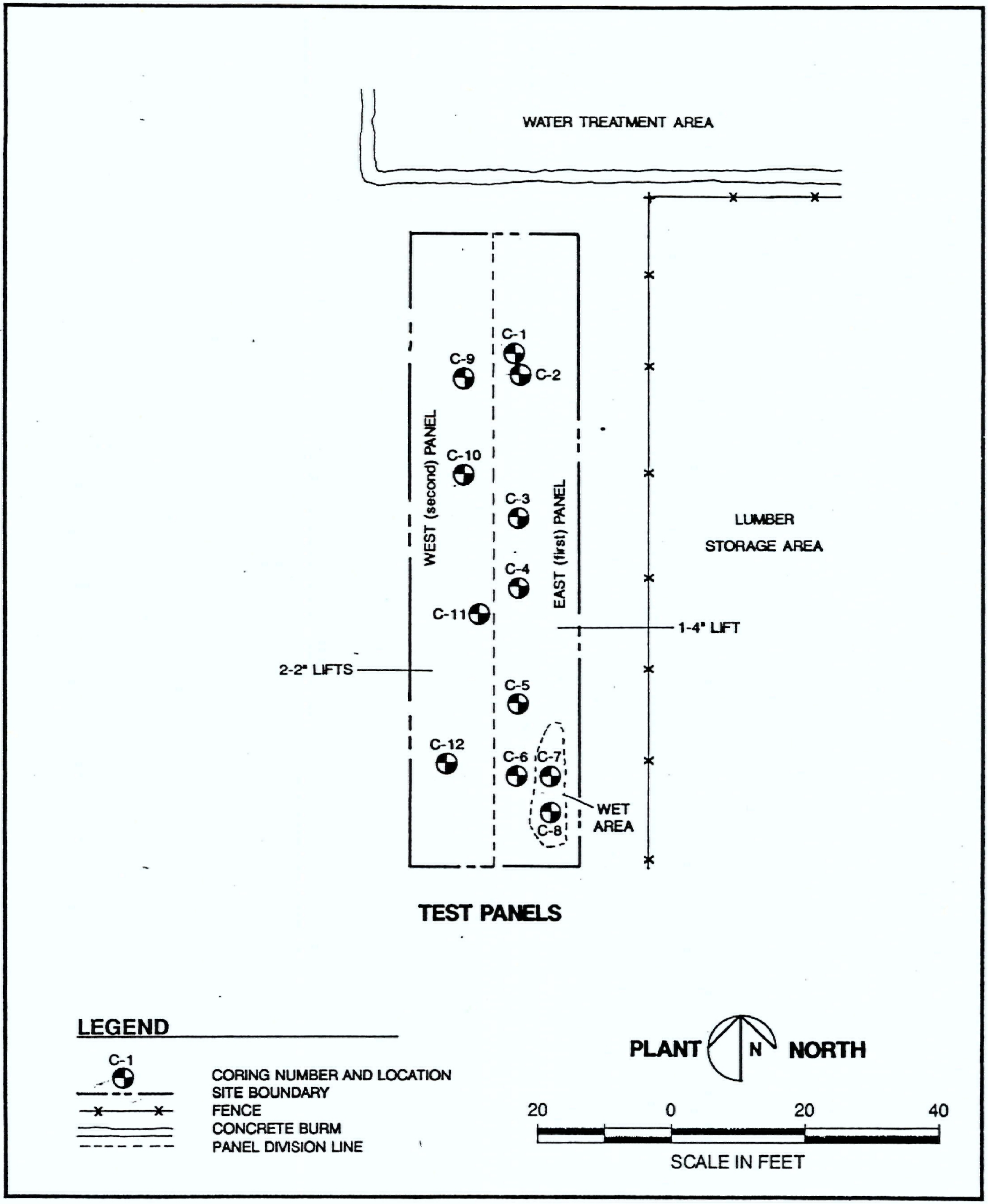

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

SITE PLAN
Weyco Cell Site
Longview, Washington

FIGURE
1A

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
1263.01	KPW		10/25/91		

1263.02
Weyerhaeuser Site Capping
Results of cores obtained 24 October 1991

Specific Gravity Data

Core Number	Height, Inches	Bulk Gs	Bulk Gs (SSD)	App. Gs	% Absorp.	Unit Wt Bulk Gs	Unit Wt Bulk SSD	Unit Wt Apparent	Bulk SSD % of Rice
1	4.24	2.370	2.388	2.415	0.78	147.9	149.0	150.7	94.7%
2	3.84	2.348	2.375	2.414	1.17	146.5	148.2	150.6	94.2%
3	3.97	2.390	2.407	2.431	0.71	149.1	150.2	151.7	95.5%
4	3.93	2.349	2.373	2.406	1.00	146.6	148.1	150.1	94.1%
5	3.64	2.394	2.411	2.435	0.70	149.4	150.4	151.9	95.6%
6	3.52	2.404	2.425	2.455	0.86	150.0	151.3	153.2	96.2%
7	3.17	2.426	2.449	2.484	0.95	151.4	152.8	155.0	97.2%
8	3.28	2.419	2.437	2.463	0.93	150.9	152.1	153.7	96.7%
9	3.76	2.371	2.384	2.402	0.54	148.0	148.8	149.9	94.6%
10	3.88	2.352	2.370	2.395	0.75	146.8	147.9	149.4	94.0%
11	3.72	2.391	2.404	2.423	0.55	149.2	150.0	151.2	95.4%
12	3.58	2.351	2.367	2.389	0.68	146.7	147.7	149.1	93.9%

Nuclear Density Test Data
Backscatter and 4" Direct Transmission tests

Maximum Theoretical Density
of A.C. (Rice): 157.2 pcf

Core Number	B.S. 1	B.S. 2	4" 1	4" 2	Average B.S.	Average 4"	% Comp. B.S.	% Comp. 4"
1	150.4	148.9	146.2	145.9	149.7	146.1	95.2	92.9
2	150.7	149.1	148.4	148.4	149.9	148.4	95.4	94.4
3	151.0	148.6	148.9	148.9	149.8	148.9	95.3	94.7
4	148.4	150.6	147.7	147.6	149.5	147.7	95.1	93.9
5	153.5	153.4	148.5	149.1	153.5	148.8	97.6	94.7
6	151.0	156.4	152.9	149.1	153.7	151.0	97.8	96.1
7	157.3	157.2	152.9	152.0	157.3	152.5	100.0	97.0
8	156.7	155.2	151.3	149.9	156.0	150.6	99.2	95.8
9	147.5	148.7	147.0	144.2	148.1	145.6	94.2	92.6
10	150.5	149.3	147.5	145.9	149.9	146.7	95.4	93.3
11	148.4	152.2	148.3	148.5	150.3	148.4	95.6	94.4
12	150.0	151.2	147.4	146.5	150.6	147.0	95.8	93.5

Applied Geotechnology Inc.
Geotechnical Engineering
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1263.02

DAILY PLANT REPORT – BITUMINOUS MIXTURES

BI NO.	REPORT NO.	SHEET OF	DATE
			23 Oct 91

PROJECT NAME (SECTION)	Capping Site
HIGHWAY	2nd Panel 2 of 4
CONTRACT NO.	
PROJECT MANAGER	
CONTRACTOR	Lakeside
SUPPLIER	Lakeside
MAKE, MODEL, SIZE OF PLANT	☐ BATCH ☐ DRUM ☐ CONT.
BRAND & GRADE OF ASPHALT	ECOMAT
MIX CLASS	
% RAP	

WEATHER CONDITIONS

AM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY
PM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY

MIXTURE USED FOR ☐ LEVELING ☐ BASE ☐ TOP

LOT NO.	SUBLOT OR TEST NO.	LOT NO.	SUBLOT OR TEST NO.
SAMPLED AT	TIME	SAMPLED AT	TIME
TONS REPRESENTED	DAILY TONNAGE AT TIME OF TEST	TONS REPRESENTED	DAILY TONNAGE AT TIME OF TEST

MIX TEMPERATURE

PLANT TIME ___ °F TIME ___ °F
ROAD TIME ___ °F TIME ___ °F

MOISTURE CONTENT

		FOR EXTRACTION TEST	MIXING PLANT DISCHARGE	FOR EXTRACTION TEST	MIXING PLANT DISCHARGE
1	TARE WT. OF CONTAINER B4	171.0			
2	WET WT. OF CONTAINER & SAMPLE	837.4			
3	DRY WT. OF CONTAINER & SAMPLE	836.6			
4	WET WT. OF SAMPLE [2]−[1]	666.4			
5	DRY WT. OF SAMPLE [3]−[1]	665.6			
6	MOISTURE (([4]−[5])÷[5]) × 100	6a 0.12 %	6b %	6a %	6b %

EXTRACTED AGGREGATE

7	TARE WT. OF CONTAINER A	1933.3	
8	WT. OF DIATOMACEOUS EARTH	100.0	
9	WT. OF FILTER PAPER	14.0 41.6 (18.6)	
10	DRY WT. OF AGGREGATE, CONTAINER, DIATOMACEOUS EARTH & FILTER	4089.8	
11	EXTR. AGGR. WT. [10]−([7]+[8]+[9])	2040.3	

EXTRACTED ASPHALT

12	WET WT. OF MIX & CONTAINER	3239.6	
13	TARE WT. OF CONTAINER	1067.5	
14	WET WT. OF MIXTURE [12]−[13]	2172.1	
15	DRY WT. OF MIX ([14]÷(100+[6a])) × 100	2169.5	
16	WT. OF EXTRACTED ASPHALT [15]−[11]	129.2	
17	ASPHALT IN MIX ([16]÷[15]) × 100	6.0 %	%

JOB MIX FORMULA & LAB. NO. / AGGREGATE GRADATION

PASS SIEVE	TARGET %	LSL — USL	PASS SIEVE	RETAINED WT.	% RET.	% PASS	RETAINED WT.	% RET.	% PASS
1"			1"						
¾"			¾"	0.0	0	100			
½"			½"	104.7	5	95			
¼"			¼"	813.2	40	60			
10			10	1426.4	70	30			
40			40	1762.1	86	14			
200			200	1920.6	94.1	5.9			
ASPHALT			PAN	2138.4					
			TOTAL	- 100.0 + 3.0 = 2041.1					

MIX PRODUCTION SUMMARY (TONS)

	THIS REPORT	CUMULATIVE
SPEC. MIX INCORP. (TON)		
NON-SPEC. INCORP. (TON)		
TOTAL INCORP. (TON)		

TIME SHIFT STARTED ____ TIME SHIFT ENDED ____

AVERAGE PRODUCTION RATE ____ TONS/HR.

SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET ____ SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET ____

REMARKS: (LIST TIME & EXTENT OF DELAYS, PLANT CHANGES, ETC.)

DISTRIBUTION: PROJECT MANAGER, REGION, ORIGINATOR & CONTRACTOR.

PREPARED BY [signature] / LAN

REVIEWED BY CONTRACTOR ____ REVIEWED BY PROJECT MANAGER ____

734-3083 (REV. 1-88)

PROJECT MANAGER

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

1263.02

DAILY PLANT REPORT – BITUMINOUS MIXTURES

BI NO. | REPORT NO. | SHEET ___ OF ___ | DATE 10/23/91

PROJECT NAME (SECTION): Weyco Capping Site
HIGHWAY: 1st Panel, 2 of 4
CONTRACT NO.
PROJECT MANAGER
CONTRACTOR
SUPPLIER
MAKE, MODEL, SIZE OF PLANT ☐ BATCH ☐ DRUM ☐ CONT.
BRAND & GRADE OF ASPHALT: ECOMAT
MIX CLASS | % RAP

WEATHER CONDITIONS

AM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY
PM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY

MIXTURE USED FOR ☐ LEVELING ☐ BASE ☐ TOP

LOT NO. | SUBLOT OR TEST NO. | SAMPLED AT | TIME | TONS REPRESENTED | DAILY TONNAGE AT TIME OF TEST

MIX TEMPERATURE

PLANT: TIME ____ °F; TIME ____ °F
ROAD: TIME ____ °F; TIME ____ °F

MOISTURE CONTENT

		For Extraction Test	Mixing Plant Discharge	For Extraction Test	Mixing Plant Discharge
1	TARE WT. OF CONTAINER C-1	165.5			
2	WET WT. OF CONTAINER & SAMPLE	1151.2			
3	DRY WT. OF CONTAINER & SAMPLE	1150.5			
4	WET WT. OF SAMPLE [2]−[1]	985.7			
5	DRY WT. OF SAMPLE [3]−[1]	985.0			
6	MOISTURE (([4]−[5])÷[5]) X 100	6a 0.07 %	6b %	6a %	6b %

EXTRACTED AGGREGATE

7	TARE WT. OF CONTAINER C	1678.4	
8	WT. OF DIATOMACEOUS EARTH	100.0	
9	WT. OF FILTER PAPER	13.1+1.6= 14.7 (17.6)	
10	DRY WT. OF AGGREGATE, CONTAINER, DIATOMACEOUS EARTH & FILTER	3649.7	
11	EXTR. AGGR. WT. [10]−([7]+[8]+[9])	1856.6	

EXTRACTED ASPHALT

12	WET WT. OF MIX & CONTAINER	3042.3	
13	TARE WT. OF CONTAINER	1067.7	
14	WET WT. OF MIXTURE [12]−[13]	1974.6	
15	DRY WT. OF MIX ([14]÷(100+[6a])) X 100	1973.2	
16	WT. OF EXTRACTED ASPHALT [15]−[11]	116.6	
17	ASPHALT IN MIX ([16]÷[15]) X 100	5.9 %	%

JOB MIX FORMULA & LAB. NO. / AGGREGATE GRADATION

Pass Sieve	Target %	LSL — USL	Pass Sieve	Retained Wt.	% Ret.	% Pass	Retained Wt.	% Ret.	% Pass
1"			1"						
¾"			¾"	0.0	0	100			
½"			½"	148.9	8	92			
¼"			¼"	689.2	37	63			
10			10	1287.2	69	31			
40			40	1609.6	87	13			
200			200	1764.5	95.0	5.0			
ASPHALT			PAN	1854.9					
			TOTAL	−100+ 2.9 = 1857.8					

MIX PRODUCTION SUMMARY (TONS)

	This Report	Cumulative
SPEC. MIX INCORP. (TON)		
NON-SPEC. INCORP. (TON)		
TOTAL INCORP. (TON)		

TIME SHIFT STARTED | TIME SHIFT ENDED
AVERAGE PRODUCTION RATE ____ TONS/HR.

SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET | SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET

REMARKS: (LIST TIME & EXTENT OF DELAYS, PLANT CHANGES, ETC.)

DISTRIBUTION: PROJECT MANAGER, REGION, ORIGINATOR & CONTRACTOR.

PREPARED BY: M Nelson / LAN
REVIEWED BY CONTRACTOR
REVIEWED BY PROJECT MANAGER

734-3083 (REV. 1-88)

PROJECT MANAGER

vement Services, Inc.
...ulting Engineers for Pavements

SPECIFIC GRAVITY OF BITUMINOUS MIXTURES

1263.02

OSHD TM 306-A WORKSHEET

DATE	WORKSHEET NO.
23 Oct 91	

...CT NAME (SECTION)	HIGHWAY	CONTRACT NO.
Capping Site	1st Panel 2 of 4	

PREPARED BY	CLASS OF MIX	JOB MIX FORMULA LAB NO.	(MDT) PCF
LBM			

JAR (PYCNOMETER) CALIBRATION (TEST PROCEDURE PART 3)

WT. OF JAR, GLASS	A	g	g	g
WT. OF WATER, JAR, GLASS	B	g	g	g
TEMPERATURE OF WATER	C	°F	°F	°F
(Gw) TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	D			
...p) VOLUME OF JAR ([B] − [A]) ÷ [D]		E1 cc	E2 cc	E3 cc
JAR NO. — CALIBRATION WORKSHEET NUMBER — (AVG. VP) ([E1] + [E2] + [E3]) ÷ 3	F	4523.0 cc		

...ECIFIC GRAVITY & MAXIMUM DENSITY (TEST PROCEDURE PARTS 5 & 6)

		LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.
WT. OF JAR, GLASS	1	2942.9 g	g	g
WT. OF SAMPLE, JAR, GLASS	2	4880.0 g	g	g
(Ws) WT. OF SAMPLE [2] − [1]	3	1937.1 g	g	g
WT. OF WATER, SAMPLE, JAR, GLASS	4	8625.0 g	g	g
(Ww) WT. OF WATER [4] − [2]	5	3745.0 g	g	g
TEMPERATURE OF WATER	6	70.3 °F	°F	°F
(Gw) TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	7	.997930		
VOLUME OF WATER [5] ÷ [7]	8	3752.8 cc	cc	cc
VOLUME OF SAMPLE [F] − [8]	9	770.2 cc	cc	cc
...) SPECIFIC GRAVITY [3] ÷ [9]	10	2.515		
(MDT) MAXIMUM DENSITY TEST RESULT [10] X 62.4	11	156.9 PCF	PCF	PCF
...FFERENCE BETWEEN [11] & LAST MAMD		PCF	PCF	PCF

MOVING AVERAGE MAXIMUM DENSITY (MAMD)

...O. OF MDTs AVERAGED	MAMD (USING MDT FROM [11])	NO.	MAMD PCF	NO.	MAMD PCF	NO.	MAMD PCF

REMARKS:

...TRIBUTION: PROJECT MANAGER, ORIGINATOR

...00 (9-90)

2942.9

5.55 ✓ 03 ✓
57 ✓ 05 ✓
59 ✓ 07 ✓
01 ✓ 09 ✓

Pavement Services, Inc.
Consulting Engineers for Pavements

SPECIFIC GRAVITY OF BITUMINOUS MIXTURES

1263.02

OSHD TM 306-A WORKSHEET

PROJECT NAME (SECTION) Weyco Capping Site	HIGHWAY 2nd Panel, 2/2	DATE 24 Oct 91	WORKSHEET NO.
			CONTRACT NO.
PREPARED BY M Nelson	CLASS OF MIX	JOB MIX FORMULA LAB NO.	(MDT) PCF

JAR (PYCNOMETER) CALIBRATION (TEST PROCEDURE PART 3)

	WT. OF JAR, GLASS	A	g	g	g
	WT. OF WATER, JAR, GLASS	B	g	g	g
	TEMPERATURE OF WATER	C	°F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	D			
(Vp)	VOLUME OF JAR ([B] − [A]) ÷ [D]		E1 cc	E2 cc	E3 cc
JAR ID. NO.	CALIBRATION WORKSHEET NUMBER	(AVG. VP) ([E1] + [E2] + [E3]) ÷ 3	F	4523.0 cc	

SPECIFIC GRAVITY & MAXIMUM DENSITY (TEST PROCEDURE PARTS 5 & 6)

			LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.
	WT. OF JAR, GLASS	1	2943.3 g	g	g
	WT. OF SAMPLE, JAR, GLASS	2	5000.7 g	g	g
(Ws)	WT. OF SAMPLE [2] − [1]	3	2057.4 g	g	g
	WT. OF WATER, SAMPLE, JAR, GLASS	4	8701 g	g	g
(Ww)	WT. OF WATER [4] − [2]	5	3700.3 g	g	g
	TEMPERATURE OF WATER	6	71 71.3 °F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	7	.997804		
	VOLUME OF WATER [5] ÷ [7]	8	3708.4 cc	cc	cc
	VOLUME OF SAMPLE [F] − [8]	9	814.6 cc	cc	cc
(Gs)	SPECIFIC GRAVITY [3] ÷ [9]	10	2.526		
(MDT)	MAXIMUM DENSITY TEST RESULT [10] X 62.4	11	157.6 PCF	PCF	PCF
	DIFFERENCE BETWEEN [11] & LAST MAMD		PCF	PCF	PCF

MOVING AVERAGE MAXIMUM DENSITY (MAMD)

NO. OF MDTs AVERAGED	MAMD (USING MDT FROM [11])	NO.	MAMD PCF	NO.	MAMD PCF	NO.	MAMD PCF

REMARKS:

DISTRIBUTION: PROJECT MANAGER, ORIGINATOR

734-1886 (4-86)

Applied Geotechnology Inc.

Geotechnical Engineering
Geology & Hydrogeology

2510 SOUTHWEST FIRST AVENUE
PORTLAND, OREGON 97201
503-222-2820

PROJECT MEMORANDUM

Date: 10/23/91

File: 1263.02

To: R. Kampe, R. Terrel, P. Seamons, File

From: Richard Fejta

Project: Weyerhaeuser Cell Site

Subject: Test Paving

☐ Telephone Call ☐ Conference ☒ Site Visit ☐ Other

1) Arrived on site as arranged at 9:00 am to observe test paving. Performed seven density tests of subgrade in test area. Compaction averaged 96.3%. Please refer to attached sheet 3/5 for details.

2) Paving contractor (Lakeside Industries) began test panels at approximately 10:45 am The first (east) panel was one 4-inch thick lift. Test results are summarized below.

PANEL SECTION	COMPACTIVE EFFORT	Avg. % COMPACTION
North Third	2 static passes	92.4%
Middle Third	2 static & 2 vibratory passes	95.5%
South Third	2 static & 4 vibratory passes	95.7%

please refer to sheet 4/5 for details

Distribution:

By: RPF

Applied Geotechnology Inc.

Geotechnical Engineering
Geology & Hydrogeology

2510 SOUTHWEST FIRST AVENUE
PORTLAND, OREGON 97201
503-222-2820

PROJECT MEMORANDUM

Date: 10/23/91

File: 1263.02

To:

From:

Project:

Subject:

☐ Telephone Call ☐ Conference ☐ Site Visit ☐ Other

3) The second (west) panel was placed in 2, 2-inch thick lifts. The first lift was compacted with 4 and 6 static passes of the steel drum roller. The second lift was compacted with 4 vibratory passes. Density test results on the second lift ranged from 94.3% to 96.4% of the Rice maximum density and averaged 95.3%. Refer to sht. 5/5 for details.

4) Temperatures of the asphalt ranged from approximately 300°F initially (1st panel, 1st pup) cooling to 240°F w/ the first truck and 230°F with the second truck and pup.

5) Arranged to return to site tomorrow to perform coring of test panels. Production paving tentatively scheduled for Tuesday 10/29/91.

6) Performed two, Rice Max densities. Results were 156.9 pcf, 157.6 pcf. Avg. = 157.2 pcf.

Distribution:

By: Richard Frojta

NUCLEAR GAUGE TESTS

Applied Geotechnology Inc.
2510 S.W. First Avenue
Portland, Oregon 97201

DATE STARTED: 10/23/91
DATE COMPLETED: 10/23/91
STANDARD COUNTS: moisture 648
density 12831

JOB NO. 1263.02
JOB NAME Weyco Site Cap
HRS. USED 6
TESTED BY RPF

TEST NO.	LOCATION	DEPTH from	PROBE DEPTH	DENSITY count	DENSITY wet	DENSITY dry	MOISTURE count	MOISTURE pcf	MOISTURE %	SAMPLE NO.	MATERIAL TYPE	MAXIMUM DENSITY STD/MOD	% COMPACTION
	Baserock Tests prior to placement of ECOMAT												
	E.5 - line	Subgrade		BS	140.8	132.3	112		6.4		1/2"-0	141.0	93.9
	wet area @ E-line	"		8"	149.1	136.4	157		9.3		"	"	96.7
	wet area @ E-line	"		8"	152.7	140.7	150		8.5		"	"	99.8
	D-line	"		8"	142.9	133.5	123		7.5		"	"	94.6
	G-line	"		8"	141.3	134.8	92		4.8		"	"	95.6
	H-line	"		8"	139.8	133.2	92		4.9		"	"	94.5
	H-line	"		BS	149.5	139.3	130		7.3		"	"	98.8
												$\bar{X}$ =	96.3%

MATERIAL TYPES:

REMARKS: 96.3% x 141.0 = 135.7 pcf

NUCLEAR GAUGE TESTS

Applied Geotechnology Inc.
2510 S.W. First Avenue
Portland, Oregon 97201

DATE STARTED: 10/23/91
DATE COMPLETED: 10/23/91
STANDARD COUNTS: moisture 648
density 2831

JOB NO. 1263.02
JOB NAME Weyco Cell Site
HRS. USED ____ TESTED BY RPF

TEST NO.	LOCATION	DEPTH from	PROBE DEPTH	DENSITY count	DENSITY wet	DENSITY dry	MOISTURE count	MOISTURE pcf	MOISTURE %	SAMPLE NO.	MATERIAL TYPE	MAXIMUM DENSITY ~~STD/MOD~~ RICE	% COMPACTION
	First (EAST) PANEL												
	North Third (2 static passes)		B.S.	825	132.7		95		5.4		ECOMAT	157.2	84.4 *
	" " " " " " "		B.S.	694	145.3		93		4.8		"	"	92.4
	Middle Third (2 static passes, 2 vib. passes)		B.S.	641	151.6		110		5.7		"	"	96.4
	" " " "		B.S.	665	148.7		96		4.9		"	"	94.6
	South Third (2 static passes, 4 vib. passes)		B.S.	654	150.0		102		5.2		"	"	95.4
	" " " " " "		B.S.	645	151.0		99		5.0		"	"	96.0

MATERIAL TYPES: ECOMAT

Equipment: BLAW-KNOX PF 500 Paver
Dynapac 42A Compactor

REMARKS: 2 Trucks w/ pups

Temperature: 1ST Pup = 302° F
1ST Truck = 240 °F

* disregard test result

NUCLEAR GAUGE TESTS

Applied Geotechnology Inc.
2510 S.W. First Avenue
Portland, Oregon 97201

DATE STARTED: 10/23/91
DATE COMPLETED: 10/23/91
STANDARD COUNTS: moisture 648
density 2831

JOB NO. 1263.02
JOB NAME Weyco Cell Site
HRS. USED
TESTED BY RPF RICE

Thin Lift correction

TEST NO.	LOCATION	DEPTH from	PROBE DEPTH	DENSITY count	DENSITY wet	DENSITY ~~dry~~	MOISTURE count	MOISTURE pcf	MOISTURE %	SAMPLE NO.	MATERIAL TYPE	MAXIMUM DENSITY ~~STD/MOD~~	CORRECTED % COMPACTION
	SECOND (WEST) PANEL												
N. 1/3	First Lift (4 static passes)	2"	B.S.	730	141.5	142.6	88		4.6		ECOMAT	157.2	90.7
S. 1/3	" " " "	2"	B.S.	682	146.6	147.7	100		5.2		"	"	93.9
M. 1/3	" " " "	2"	B.S.	720	142.5	143.6	86		4.4		"	"	91.3
M. 1/3	First Lift (6 static passes)	2"	B.S.	684	146.4	147.5	100		5.2		"	"	93.8
N. 1/3	" " " "	2"	B.S.	666	148.6	149.7	91		4.5		"	"	95.2
	SECOND LIFT (4 Vib passes)												
	North Third	4"	B.S.	667	148.4		101		5.2		"	"	94.4
	" "	4"	B.S.	641	151.6		103		5.3		"	"	96.4
	Middle Third	4"	B.S.	650	150.5		98		5.0		"	"	95.7
	" "	4"	B.S.	651	150.4		93		4.6		"	"	95.7
	South Third	4"	B.S.	668	148.2		108		5.7		"	"	94.3
	" " " "	4"	B.S.	655	149.8		104		5.4		"	"	95.3

MATERIAL TYPES:

REMARKS:
TEMPERATURES:
1st LIFT (Pup) 205° - 230°
2nd Lift (Truck) 230°

Appendix B of Applied Geotechnology, Inc. Document

APPLIED GEOTECHNOLOGY INC.

SPECIFIC GRAVITY OF BITUMINOUS MIXTURES

1263-2

OSHD TM 306-A WORKSHEET

PROJECT NAME (SECTION)	HIGHWAY	DATE	WORKSHEET NO.
NEYCO CAPPING SITE	Sample 1A	30 OCT 91	
PREPARED BY	CLASS OF MIX	CONTRACT NO.	
LAN	ECOMAT	1263.02	
		JOB MIX FORMULA LAB NO.	(MDT) PCF

JAR (PYCNOMETER) CALIBRATION (TEST PROCEDURE PART 3)

	WT. OF JAR, GLASS	A	g	g	g
	WT. OF WATER, JAR, GLASS	B	g	g	g
	TEMPERATURE OF WATER	C	°F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	D			
Vp)	VOLUME OF JAR ([B]−[A]) ÷ [D]		E1 cc	E2 cc	E3 cc
LAB. NO.	CALIBRATION WORKSHEET NUMBER	(AVG. VP) ([E1] + [E2] + [E3]) ÷ 3	F	4523 cc	

SPECIFIC GRAVITY & MAXIMUM DENSITY (TEST PROCEDURE PARTS 5 & 6)

			LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.
	WT. OF JAR, GLASS	1	2943.2 g	g	g
	WT. OF SAMPLE, JAR, GLASS	2	4488.5 g	g	g
Ws)	WT. OF SAMPLE [2]−[1]	3	1545.3 g	g	g
	WT. OF WATER, SAMPLE, JAR; GLASS	4	8383.8 g	g	g
Ww)	WT. OF WATER [4]−[2]	5	3895.3 g	g	g
	TEMPERATURE OF WATER	6	67.6 °F	°F	°F
Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	7	0.998252		
	VOLUME OF WATER [5]÷[7]	8	3902.1 cc	cc	cc
	VOLUME OF SAMPLE [F]−[8]	9	620.9 cc	cc	cc
(Gs)	SPECIFIC GRAVITY [3]÷[9]	10	2.49		
(MDT)	MAXIMUM DENSITY TEST RESULT [10] X 62.4	11	155.4 PCF	PCF	PCF
	DIFFERENCE BETWEEN [11] & LAST MAMD		PCF	PCF	PCF

MOVING AVERAGE MAXIMUM DENSITY (MAMD)

NO. OF MDTs AVERAGED	MAMD (USING MDT FROM [11])	NO.	MAMD PCF	NO.	MAMD PCF	NO.	MAMD PCF

REMARKS:

1A = 155.4
2A = 154.5
3A = 155.5
4A = 154.9
Avg: 155.1

DISTRIBUTION: PROJECT MANAGER, ORIGINATOR

$G_w = \frac{W_w}{V_w} = 62.4 pcf$

$V_w = \frac{W_w}{W_w/V_w} = \frac{W_w}{G_w} = V_w$

APPLIED GEOTECHNOLOGY INC.

SPECIFIC GRAVITY OF BITUMINOUS MIXTURES

1263.02

OSHD TM 306-A WORKSHEET

SHEET NAME (SECTION): Weyco Capping Project	HIGHWAY: Sample 2-B 539 Turns	DATE: 11/4/91	WORKSHEET NO.
PREPARED BY: WBM	CLASS OF MIX: ECOMAT	JOB MIX FORMULA LAB NO.	(MDT) PCF

JAR (PYCNOMETER) CALIBRATION (TEST PROCEDURE PART 3)

	WT. OF JAR, GLASS	A	g	g	g
	WT. OF WATER, JAR, GLASS	B	g	g	g
	TEMPERATURE OF WATER	C	°F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	D			
(Vp)	VOLUME OF JAR ([B] − [A]) ÷ [D]		E1 cc	E2 cc	E3 cc
JAR NO.	CALIBRATION WORKSHEET NUMBER	(AVG. VP) ([E1] + [E2] + [E3]) ÷ 3	F	4523.0 cc	

SPECIFIC GRAVITY & MAXIMUM DENSITY (TEST PROCEDURE PARTS 5 & 6)

			LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.
	WT. OF JAR, GLASS	1	2942.4 g	g	g
	WT. OF SAMPLE, JAR, GLASS	2	5008.2 g	g	g
(Ws)	WT. OF SAMPLE [2] − [1]	3	2065.8 g	g	g
	WT. OF WATER, SAMPLE, JAR, GLASS	4	8686.0 g	g	g
(Ww)	WT. OF WATER [4] − [2]	5	3677.8 g	g	g
	TEMPERATURE OF WATER	6	76.7 °F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	7	.997090		
	VOLUME OF WATER [5] ÷ [7]	8	3688.5 cc	cc	cc
	VOLUME OF SAMPLE [F] − [8]	9	834.5 cc	cc	cc
(Gs)	SPECIFIC GRAVITY [3] ÷ [9]	10	2.475		
(MDT)	MAXIMUM DENSITY TEST RESULT [10] X 62.4	11	154.5 PCF	PCF	PCF
	DIFFERENCE BETWEEN [11] & LAST MAMD		PCF	PCF	PCF

MOVING AVERAGE MAXIMUM DENSITY (MAMD)

NO. OF MDTs AVERAGED	MAMD (USING MDT FROM [11])	NO. / MAMD PCF	NO. / MAMD PCF	NO. / MAMD PCF

REMARKS:

DISTRIBUTION: PROJECT MANAGER, ORIGINATOR

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APPLIED GEOTECHNOLOGY INC.

SPECIFIC GRAVITY OF BITUMINOUS MIXTURES

1263.02

OSHD TM 306-A WORKSHEET

PROJECT NAME (SECTION): Wey Co Capping Site	HIGHWAY: Sample 3-A	DATE: 11/4/91	WORKSHEET NO.
PREPARED BY: BM	CLASS OF MIX: ECOMAT	JOB MIX FORMULA LAB NO.	CONTRACT NO. / (MDT) PCF

JAR (PYCNOMETER) CALIBRATION (TEST PROCEDURE PART 3)

	WT. OF JAR, GLASS	A	g	g	g
	WT. OF WATER, JAR, GLASS	B	g	g	g
	TEMPERATURE OF WATER	C	°F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	D			
(Vp)	VOLUME OF JAR ([B] − [A]) ÷ [D]		E1 cc	E2 cc	E3 cc
LAB NO.	CALIBRATION WORKSHEET NUMBER	(AVG. VP) ([E1] + [E2] + [E3]) ÷ 3	F	4523.cc	

SPECIFIC GRAVITY & MAXIMUM DENSITY (TEST PROCEDURE PARTS 5 & 6)

			LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.
	WT. OF JAR, GLASS	1	2942.4 g	g	g
	WT. OF SAMPLE, JAR, GLASS	2	4837.3 g	g	g
(Ws)	WT. OF SAMPLE [2] − [1]	3	1894.9 g	g	g
	WT. OF WATER, SAMPLE, JAR; GLASS	4	8589.0 g	g	g
(Ww)	WT. OF WATER [4] − [2]	5	3751.7 g	g	g
	TEMPERATURE OF WATER	6	76.2 °F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	7	.997186		
	VOLUME OF WATER [5] ÷ [7]	8	3762.1 cc	cc	cc
	VOLUME OF SAMPLE [F] − [8]	9	760.6 cc	cc	cc
(Gz)	SPECIFIC GRAVITY [3] ÷ [9]	10	2.491		
(MDT)	MAXIMUM DENSITY TEST RESULT [10] X 62.4	11	155.5 PCF	PCF	PCF
	DIFFERENCE BETWEEN [11] & LAST MAMD		PCF	PCF	PCF

MOVING AVERAGE MAXIMUM DENSITY (MAMD)

NO. OF MDTs AVERAGED	MAMD (USING MDT FROM [11])	NO.	MAMD PCF	NO.	MAMD PCF	NO.	MAMD PCF

REMARKS:

DISTRIBUTION: PROJECT MANAGER, ORIGINATOR

1000 (4-00)

'avement Services, Inc.
—onsulting Engineers for Pavements

SPECIFIC GRAVITY OF BITUMINOUS MIXTURES

1263.02

OSHD TM 306-A WORKSHEET

PROJECT NAME (SECTION) Weyco Capping Site	HIGHWAY Sample H-A 1702 Tons	DATE 11/5/91	WORKSHEET NO.
PREPARED BY IBM	CLASS OF MIX ECOMAT	CONTRACT NO.	
		JOB MIX FORMULA LAB NO.	(MDT) PCF

JAR (PYCNOMETER) CALIBRATION (TEST PROCEDURE PART 3)

	WT. OF JAR, GLASS	A	g	g	g
	WT. OF WATER, JAR, GLASS	B	g	g	g
	TEMPERATURE OF WATER	C	°F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	D			
(Vp)	VOLUME OF JAR (B − A) ÷ D		E1 cc	E2 cc	E3 cc
LAB NO.	CALIBRATION WORKSHEET NUMBER	(AVG. VP)	(E1 + E2 + E3) ÷ 3	F	4523.0 cc

SPECIFIC GRAVITY & MAXIMUM DENSITY (TEST PROCEDURE PARTS 5 & 6)

			LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.	LOT NO. / SUBLOT OR TEST NO.
	WT. OF JAR, GLASS	1	2942.4 g	g	g
	WT. OF SAMPLE, JAR, GLASS	2	4770.8 g	g	g
(Ws)	WT. OF SAMPLE 2 − 1	3	1828.4 g	g	g
	WT. OF WATER, SAMPLE, JAR, GLASS	4	8546.7 g	g	g
(Ww)	WT. OF WATER 4 − 2	5	3775.9 g	g	g
	TEMPERATURE OF WATER	6	76.2 °F	°F	°F
(Gw)	TEMPERATURE CONVERSION FACTOR (FROM TABLE 1)	7	.997166		
	VOLUME OF WATER 5 ÷ 7	8	3786.6 cc	cc	cc
	VOLUME OF SAMPLE F − 8	9	736.4 cc	cc	cc
(Gz)	SPECIFIC GRAVITY 3 ÷ 9	10	2.483		
(MDT)	MAXIMUM DENSITY TEST RESULT 10 X 62.4	11	154.9 PCF	PCF	PCF
	DIFFERENCE BETWEEN 11 & LAST MAMD		PCF	PCF	PCF

MOVING AVERAGE MAXIMUM DENSITY (MAMD)

NO. OF MDTs AVERAGED	MAMD (USING MDT FROM 11)	NO. / MAMD PCF	NO. / MAMD PCF	NO. / MAMD PCF

REMARKS:

DISTRIBUTION: PROJECT MANAGER, ORIGINATOR

1080 (0-00)

Appendix C of Applied Geotechnology, Inc. Document

Applied Geotechnology Inc.

Geotechnical Engineering
Geology & Hydrogeology

2510 SOUTHWEST FIRST AVENUE
PORTLAND, OREGON 97201
503-222-2820

PROJECT MEMORANDUM

Date: 10/29/91

File: 1263.02

To: RPF & File

From: Lauren B. McCann

Project: Weyerhaeuser Capping Site - Longview, Wash.

Subject: Placement of Asphalt Surfacing

☐ Telephone Call ☐ Conference ☒ Site Visit ☐ Other

Andy Newlands and I arrived on-site at 7:00 AM, as requested, to observe paving operations, and perform nuclear field density tests on the completed surface.

During the course of paving, we had been requested to monitor the asphalt temperatures during placement of the material, especially on the panel edges. This monitoring was to determine if panel edges fell below 170°F before the paving machine returned to place the next panel. If temperatures fell below 170° the contractor was to be notified, so that he could pull back and start placing the next panel. If the edge temperature fell below 150°F, the edges were to be reheated so that a good bonding of the two panel edges could be accomplished. The early truck loads of asphalt came on-site with temperatures ranging from 250° to 300°F, and an average temperature of 275°F. Due to the cold air temperature the material cooled rapidly after placement. The batch plant was contacted by the Supt. for Lakeside Paving Co., and the batch temperatures were raised. After 9:00 AM±, the out of truck temperatures ranged from 250° to 325°F, with an average temperature of 296°F. The edges of the north-south panels never fell below 150°F so no reheating of the edges was necessary. However, where the north south panels

Distribution:

By: LBM

Applied Geotechnology Inc.

Geotechnical Engineering
Geology & Hydrogeology

2510 SOUTHWEST FIRST AVENUE
PORTLAND, OREGON 97201
503-222-2820

PROJECT MEMORANDUM

Date: 10/29/91 File: 1263.02

To:

From:

Project:

Subject:

☐ Telephone Call ☐ Conference ☐ Site Visit ☐ Other

abutted the east-west end panels, reheating of the edges was necessary, and was done before the panels were placed against them. On the northwest side of the site, where hand work had to be done under and around pipe supports and structures, the edges of the asphalt also had to be reheated prior to placing adjacent panels.

As placement of the panels continued throughout the day, nuclear density tests were performed to determine the degree of compaction obtained under various passes with the large and small rollers. It was determined that the 97% compaction requirement could generally be met by four passes of the large roller and two or three passes with the small roller. Upon final rolling the individual panels of asphalt were tested for compaction, the results of which are included in this report.

The paving was not completed until well after dark (approx 6:30) so final testing of the last asphalt panels placed could not be accomplished today. This final testing will be done when we return to the site for core drilling of the asphalt, to obtain samples for laboratory testing.

During paving four sets of asphalt samples were obtained from the asphalt mat. One set for each approx. 500 to 600 tons. 2405 total tons placed today.

Distribution:

By: Dave B. McC[illegible]

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

ASPHALT NUCLEAR DENSITY TESTS

GAUGE # B
STD CT:
DENS 3185
MOIS 624

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97%

JOB# 1263.02
JOB NAME Weyco Gypsum Site
DATE 10/29/91
TESTED BY L.A.N.

Avg. Rice=155.

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	DENS (Average)	% (Average)	* Adjusted Avg. % Com.
1	P-1 1-Left	163.5	104	158.1	101.2					161.3	102.6	104.0*
2	P-1 2-Right	157.6	100.2	158.3	100.7					158.0	100.4	101.9
3	P-1 3-L	156.7	99.6	154.5	98.2					155.6	98.9	100.3
4	P-1 4-R	153.5	97.6	151.7	96.5					152.6	97.0	98.4
5	P-2 1-R	158.8	101.0	158.5	100.8					158.6	100.9	102.2
6	P-2 2-L	158.6	100.9	160.5	102.0					159.6	101.4	102.9
7	P-2 3-R	157.6	100.2	157.9	100.4					157.8	100.3	101.7
8	P-2 4-L	154.6	98.3	155.6	98.9					155.1	98.6	100.0
9	P-3 1-R	156.7	99.6	154.5	98.3					155.6	99.0	100.3
10	P-3 2-L	157.5	100.1	156.1	99.3					156.8	99.7	101.1

Applied Geotechnology Inc.
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ASPHALT NUCLEAR DENSITY TESTS

GAUGE # 8
STD CT:
DENS 3185
MOIS 629

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97%

JOB# 1263.02
JOB NAME Weyco Capping Site
DATE 10/21/91
TESTED BY L.A.K

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	DENS (Average)	% (Average)	Adjusted Avg % Comp
11	P-3 3-R	156.9	99.8	155.2	98.7					156.0	99.2	100.6
12	P-3 4-L	151.2	96.2	150.9	96.0					151.1	96.1	97.4
13	P-4 1-R	152.5	97.0	152.5	96.9					152.5	97.0	98.3
14	P-4 2-L	154.3	98.1	154.1	98.0					154.2	98.0	99.4
15	P-4 3-R	154.3	98.1	154.5	98.3					154.4	98.2	99.5
16	P-5 1-L	150.7	95.8	151.0	96.0					150.3	95.9	96.9
17	P-5 2R	154.8	98.4	154.7	98.3					154.8	98.4	99.8
18	P-6 1-L	143.6	91.3	146.4	93.1					145.0	92.2	93.5
19	P-6 2-R	156.9	99.7	158.0	100.5					157.4	100.1	101.5
20	P-6 3-L	154.1	98.0	154.6	98.3					154.4	98.2	99.5

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ASPHALT NUCLEAR DENSITY TESTS

GAUGE # 8
STD CT:
DENS 3185
MOIS 629

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97%

JOB# 1263.02
JOB NAME Weyco Shipping Tek
DATE 10/29/91
TESTED BY KAV

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	Average DENS	Average %	Adjusted Avg. % Comp.
21	P-7 1-R	153.7	97.7	157.9	100.4					155.8	99.0	100.4
22	P-7. 2-L	157.4	100.1	156.3	99.4					156.8	99.8	101.1
23	P-7 3-R	157.2	100.0	156.0	99.2					156.6	99.6	101.0
24	P-7 4-L	156.6	99.6	155.3	98.7					156.0	99.2	100.6
25	P-8 1-L	154.1	98.0	154.1	98.0					154.1	98.0	99.4
26	P-8 2-R	157.6	100.2	154.8	98.4					156.2	99.3	100.7
27	P-8 3-L	159.5	101.4	158.1	100.6					158.8	101.0	102.4
28	P-8 4-R	155.9	99.2	156.6	99.5					156.2	99.4	100.7
29	P-9 1R	150.9	95.9	147.7	93.9					149.3	94.9	96.3
30	P-9 2-L	156.7	99.6	156.6	99.6					156.6	99.6	101.0

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

ASPHALT NUCLEAR DENSITY TESTS

GAUGE # B
STD CT:
DENS 3185
MOIS 629

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97%

JOB# 1263.02
JOB NAME Weyco Capping Site
DATE 10/29/91
TESTED BY LAN

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	Average DENS	Average %	Adjusted Avg. % Comp
31	P9 3-R	151.7	96.5	154.4	98.2					153.0	97.4	98.6
32	P9 4-L	156.6	99.6	152.5	96.9					154.6	98.3	99.7
33	P-10 1-L	156.9	99.8	155.6	98.9					156.2	99.4	100.7
34	P-10 2-R	154.0	97.9	158.0	100.5					156.0	99.2	100.6
35	P-10 3-L	154.0	97.9	149.8	95.3					151.9	96.6	97.9
36	P-10 4-R	157.2	100.0	155.8	99.0					156.5	99.5	100.9
37	P-10 5-L	155.7	99.0	157.2	100.0					156.4	99.5	100.8
38	P-11 1-R	155.8	99.1	157.6	100.2					156.7	99.6	101.0
39	P-11 2-L	151.1	96.1	153.7	97.7					152.4	96.9	98.3
40	P-11 3-R	158.5	100.8	158.2	100.6					158.4	100.7	102.1

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

ASPHALT NUCLEAR DENSITY TESTS

GAUGE # B
STD CT:
DENS 3185
MOIS 621

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97

JOB# 1263.02
JOB NAME Wyco Copping Site
DATE 10/29/31
TESTED BY LAN

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	DENS (Average)	% (Average)	Adjusted Avg. % Comp
41	P-11 4-L	152.1	96.7	153.9	97.9					153.0	97.3	98.6
42	P-11 5-R	155.7	99.0	157.7	100.3					156.7	99.6	101.0
43	P-11 6-L	152.4	96.9	153.2	97.4					152.8	97.2	98.5
44	P-11 7-R	155.7	99.0	158.8	101.0					157.2	100.0	101.4
45	P-11 8-L	153.9	97.9	155.2	98.7					154.6	98.3	99.7
46	P-12 1-L	153.6	97.7	156.8	99.7					155.2	98.7	100.
47	P-12 2-R	156.3	99.4	153.0	97.3					154.6	98.4	99.7
48	P-12 3-L	158.8	101.0	159.7	101.5					159.2	101.2	103.0
49	P-12 4-R	157.6	100.2	156.7	99.6					157.2	99.9	101.4
50	P-12 5-L	158.2	100.6	159.9	101.7					159.0	101.2	102.5

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

ASPHALT NUCLEAR DENSITY TESTS

GAUGE # B
STD CT:
DENS 3185
MOIS 629

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97

JOB# 1263.02
JOB NAME Wey Co Capping Site
DATE 10/29/91
TESTED BY LAN

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	DENS (Average)	% (Average)	Adjusted Avg. % Comp
51	P-13 1-R	156.1	99.3	156.6	99.6					156.4	99.5	100.8
52	P-13 2-L	154.2	98.1	154.0	97.9					154.1	98.0	97.4
53	P-13 3-R	154.3	98.1	152.0	96.6					153.2	97.4	98.8
54	P-13 4-L	158.4	100.7	156.8	99.7					157.6	100.2	101.6
55	P-13 5-R	153.6	97.7	152.1	96.7					152.4	97.2	98.3
56	P-13 6-L	155.8	99.1	158.4	100.7					157.1	99.9	101.3
57	P-13 7-R	154.7	98.4	155.5	98.9					155.1	98.6	100.0
58	P-13 8-L	154.4	98.8	157.0	99.8					155.7	99.3	100.[illegible]
59	P-14 1-R	156.6	99.6	157.0	99.8					156.6	99.7	101.[illegible]
60	P-14 2-L	157.6	100.2	155.5	98.9					156.6	99.6	101.0

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

ASPHALT NUCLEAR DENSITY TESTS

GAUGE # B
STD CT:
DENS 3185
MOIS 629

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97

JOB# 1263.02
JOB NAME Weyco Capping Site
DATE 10/21/91
TESTED BY LAN

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	DENS (Average)	% (Average)	Adjusted Avg. % Comp
61	P-14 3-R	157.3	100.1	156.0	99.2					156.6	99.6	101.0
62	P-14 4-L	153.4	97.5	156.8	99.7					155.1	98.6	100.0
63	P-14 5-R	153.8	97.8	156.3	99.4					155.0	98.6	99.9
64	P-15 1-R	156.3	99.4	154.7	98.4					155.5	98.9	100.3
65	P-15 2-L	153.1	97.3	154.7	98.1					153.9	97.7	99.2
66	P-15 3-R	156.8	99.7	153.2	97.4					155.0	98.6	99.
67	P-15 4-L	153.8	97.8	153.6	97.7					153.7	97.8	99.
68	P-15 5-R	153.9	97.9	152.7	97.1					153.6	97.5	99.
69	P-16 1-L	153.9	97.8	152.2	96.8					153.0	97.3	98
70	P-16 2-R	153.3	97.5	155.8	99.1					154.6	98.3	99.7

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

ASPHALT NUCLEAR DENSITY TESTS

GAUGE # D
STD CT:
DENS 3185
MOIS 629

SUPPLIER Lakeside
PAVER Lakeside
MIX
RICE 157.2
% REQUIRED 97

JOB# 1263.02
JOB NAME Weyco Capping Site
DATE 10/31/9?
TESTED BY LBM

TEST #	LOCATION	DENS	%	DENS	%	DENS	%	DENS	%	DENS (Average)	% (Average)	Adjusted Avg. % Comp
101	P-23 3-L	144.3	91.8	145.9	92.8					145.1	92.3	93.6
102	P-24 1-R	149.4	95.0	147.0	93.5					148.2	94.2	95.6
103	P-24 2-L	149.7	95.2	148.4	94.4					149.0	94.8	96.1
104	P-24 3-R	152.6	97.0	153.6	97.7					153.1	97.4	98.7
105	P-25 1-R	153.8	97.8	155.6	99.0					154.7	98.4	99.7
106	P-25 2-L	152.3	96.8	150.6	95.8					151.4	96.3	97.6
107	P-25 3-R	149.8	95.3	150.6	95.8					150.2	95.6	96.8

104 → 93.1

$\bar{X} = 99.2\%$

$S = 2.25$

Appendix D of Applied Geotechnology, Inc. Document

1253.02
Weyerhaeuser Site Capping
Results of cores obtained November 1, 1991

Core Number	Height, Inches	Bulk Gs	Bulk Gs (SSD)	App. Gs	% Absorp.	Unit Wt Bulk Gs	Unit Wt Bulk SSD	Unit Wt Apparent	Bulk SSD % of Rice
13	3.60	2.415	2.420	2.429	0.24	150.7	151.0	151.6	97.4
14	4.47	2.413	2.419	2.427	0.22	150.6	150.9	151.4	97.3
15	4.58	2.436	2.440	2.446	0.16	152.0	152.3	152.6	98.2
16	3.97	2.375	2.382	2.392	0.29	148.2	148.6	149.3	95.8
17	3.85	2.371	2.383	2.399	0.48	148.0	148.7	149.7	95.9
19	4.90	*	*	2.374	*	*	*	148.1	
20	4.58	2.372	2.385	2.403	0.54	148.0	148.8	149.9	96.0
21	4.54	2.436	2.440	2.447	0.18	152.0	152.3	152.7	98.2
22	3.34	2.344	2.363	2.390	0.82	146.3	147.5	149.1	95.1
23	3.52	2.404	2.411	2.421	0.29	150.0	150.4	151.1	97.0
									======
					Average core compaction =				96.75%

Summary of Backscatter Nuclear Density Tests

Maximum Theoretical Density
of A.C. (Rice): 155.1

Core Number	B.S. 1	B.S. 2	Average B.S.	% Comp. B.S.
13	155.8	154.3	155.1	100.0
14	154.9	155.8	155.4	100.2
15	159.4	157.9	158.7	102.3
16	154.6	154.3	154.5	99.6
17	151.6	149.8	150.7	97.2
19	144.2	146.4	145.3	93.7
20	155.4	153.1	154.3	99.5
21	153.2	155.3	154.3	99.5
22	154.4	153.9	154.2	99.4
23	153.8	153.1	153.5	98.9
				======
Average backscatter compaction =				99.01%

Appendix E of Applied Geotechnology, Inc. Document

2/3

Table 1 Summary of Test Results

Specimen no.	Thickness in.	Resilient Modulus ,ksi			Permeability cm/sec,(XE−9)	
		Side A	Side B	Av. MR		
C−13A	2.23	200	217	209	impermeable	
C−14A	4.00	145	140	143	impermeable	
C−15A	3.89	148	140	144	impermeable	
C−16A	3.58	154	150	152	impermeable	
C−17A	3.16	119	103	111	7.78	
C−18A						
C−19A	3.19	159	168	164	2.88	hot jt.
C−20A	4.00	154	160	157	impermeable	
C−21A	3.88	105	103	104	impermeable	cold jt.
C−22A	3.00	127	130	129	0.56	cold jt.
C−23A	3.15	160	170	165	impermeable	

Permeability Test :

Spec. no.	Differential Pressure ,in. Hg				Flow Rate ,cf/h			
C−17A	1.4	2.4	3	3.6	6	8	9	10
C−19A	3	4.1	6.5	−	2	3.5	4.5	−
C−22A	0.85	3.2	6	−	200 cc/min	400 cc/min	540 cc/min	−

Appendix D

Polymer Modified Asphalt (PMA) Concrete
by
Terrell Research
Edmonds, Washington
for
Former No. 1 Cell Room Site
Weyerhaeuser Company
Longview, Washington

PDX947/040.51

ECOMAT
POLYMER MODIFIED ASPHALT CONCRETE

Used For Capping #1 Cell Room Site
Weyerhaeuser Paper Company, Longview, WA

by

TERREL RESEARCH
9703 - 241 Place SW
Edmonds, WA 98020
Ph.(206)542-9223
FAX(206)542-6159

November 22, 1991

Executive Summary

The Weyerhaeuser Paper Company of Longview, Washington completed the closure of their site on which former #1 Cell Room once stood. Upon removal of the structure and adjacent mercury contaminated soil, the site was filled and graded, subdrains were installed, and a special pavement cover was constructed. This proprietary polymer modified asphalt concrete, ECOMAT, was designed for very low permeability, yet strong enough to support normal light traffic such as vehicle parking.

On October 23, 1991 a trial section was constructed, samples obtained and tested, and a final design was developed. The 4-in. thick mat (pavement) was constructed on Oct. 29, 1991 by Lakeside Industries and covered about 100,000 sq.ft. and used a total of about 2,500 tons of hot mix. The ECOMAT was placed using conventional paving equipment and techniques, but also included considerable 'hand work' around appurtenances. The final closure site has the appearance of a conventional asphalt pavement, but has a somewhat more dense texture at the surface.

Results of tests on core samples showed that the properties of the ECOMAT are adequate and average values are summarized as follows:

Thickness	4.14 in.
Density	96.75% of maximum
Voids	3.25%
Permeability	mostly impermeable, but all $< 1 \times 10^{-8}$ cm/sec., including the cold joints
Resilient Modulus	148,000 psi

In conclusion it appears that the constructed surface will provide the strong, impermeable cover that was desired.

Introduction

Following demolition of the #1 Cell Room at Weyerhaeuser Paper Company in Longview, WA, a closure plan was designed that included asphalt concrete. Figure 1 shows a typical cross section of the site, which contained minor levels of mercury under the former building. All the building debris and adjacent soil materials had previously been trucked to the regional landfill site in Arlington, OR.

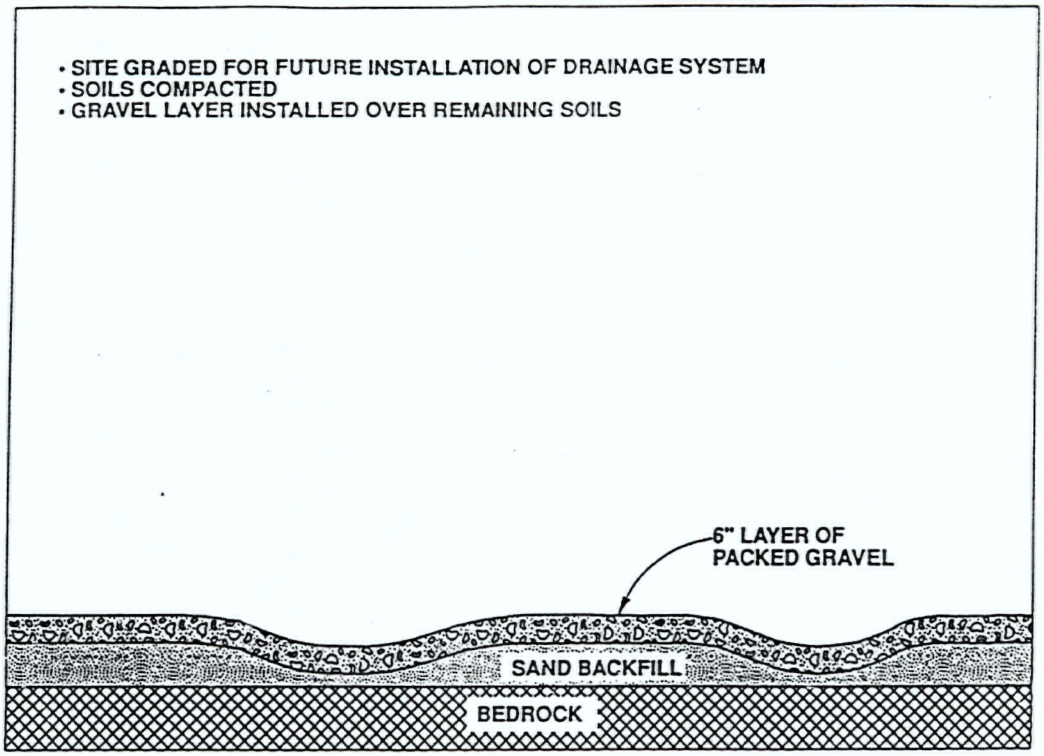
In conjunction with engineers from CH2M-Hill, Terrel Research developed a specification for low permeability polymer modified asphalt concrete, a proprietary system known as ECOMAT. This specification is included in Appendix A. It includes both binder and mixture requirements; the principal feature was a virtually impermeable surface that could be used for light vehicular traffic or storage.

This report includes data and discussion of several items, including:

- Specifications
- Mixture design
- Trial paving section
- Main paving operation

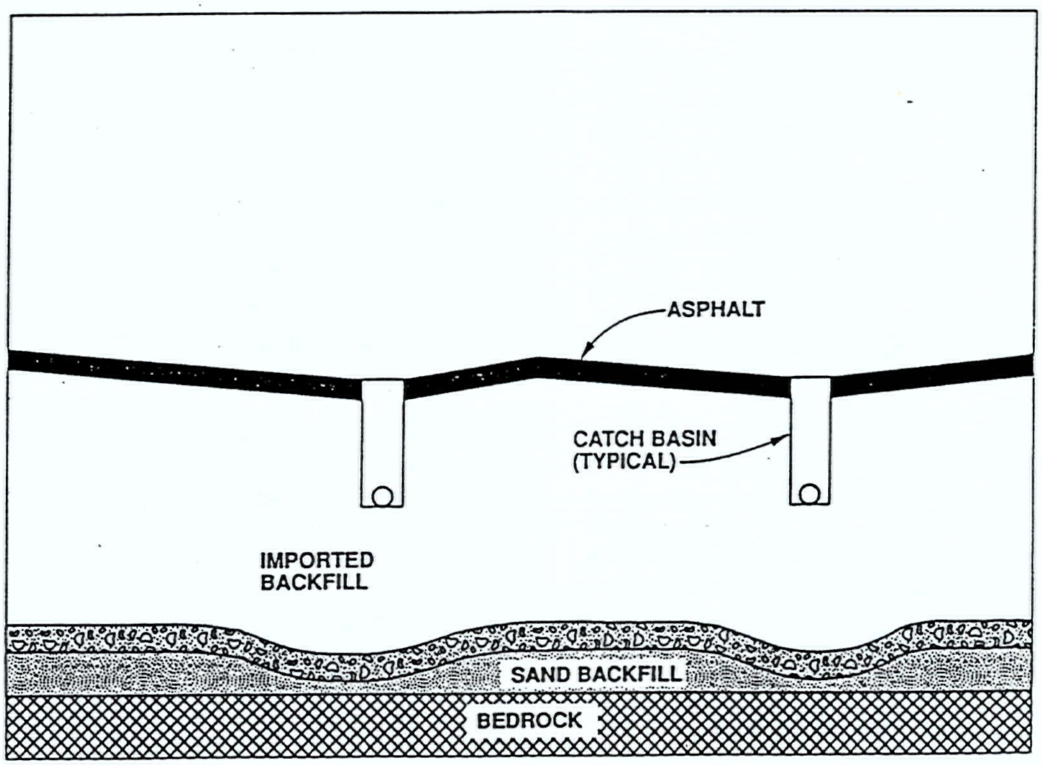
Weyerhaeuser was required to meet particular guidelines they had developed in conjunction with the Washington State Department of Ecology. Accordingly, significant care was exercised to assure that a satisfactory closure resulted. Several key persons and firms played roles in this activity, and included at least the following:

Weyerhaeuser Co.	- Jim Sims - Paul Seamons, consultant
CH2M-Hill	- Larry Well - John Doran
Kampe Associates	- Ron Kampe
Applied Geotechnology Inc.	- Richard Fejta - Mike Nolan
Lakeside Industries	- Randy Dec - Mike LaFave - Bill Dempsey
Terrel Research	- Ron Terrel



SCHEMATIC OF NO. 1 CELL ROOM SITE

(PRESENT CONFIGURATION)



SCHEMATIC OF NO. 1 CELL ROOM SITE

(FUTURE CONFIGURATION)

FIGURE - 1 - Configuration of Cross Section Paving Before and After Construction.

Mixture Design

A mixture design was prepared, using aggregate samples provided by the paving contractor, Lakeside Industries, and Ecomat-60 binder from Chevron Asphalt. Because of special requirements, the testing was conducted in the Asphalt Research Laboratory, Oregon State University, Corvallis, Oregon. The results are summarized in Appendix B.

A range of binder content was used with aggregate meeting the specified gradation as shown in Figure 1, Appendix B. The results showed that above 6.5 percent binder, the mixture was essentially impermeable. As expected, the resilient modulus (M_R) decreased with increasing binder and was somewhat lower than expected. Figure 3 of Appendix B shows the decrease in air voids (and consequently, density) with increasing binder content and this relationship was used for correlation with nuclear gage test results.

The job mix formula for the trial section was provided to Lakeside Industries and included aggregate gradation and 6.7 percent binder. Note that this was revised for the main project paving as discussed below (and shown in Appendix D).

Trial Section

On Oct. 23, 1991, two test strips were paved along the east edge of the main site. The test results are summarized in Appendix C.

The trial section was used to evaluate the mixture, particularly compaction characteristics. A nuclear gage was used to monitor density following various levels of compaction in a single 4-in. thick lift in the first strip. The second strip was paved in two 2-in. lifts (see Figure 1, Appendix C). This part of the trial was intended to compare one vs. two lift paving, but because of the schedule, the first underlying 2-in. lift was still warm when the second 2-in. lift was placed.

Following the trial paving, core samples were cut from the pavement and analyzed. Appendix C includes the data obtained by AGI. The compaction effort vs. density was plotted (Appendix C) and showed a general increase in density with roller passes for the 4-in. lift. The nuclear tests showed about 1.0 percent higher density than measured from the core samples. From these results, it was determined that adequate density (i.e., voids and therfore, permeability) could be achieved with 4 passes of the contractor's roller. Maximum density (Rice method) averaged 157.2 lb/cf and the extracted asphalt content of 5.9% was lower than expected. (note: conventional extraction procedures for asphalt often result in lower values for polymer modified asphalt)

asphalt often result in lower values for polymer modified asphalt)

Based upon analysis of the trial section, a revised job mix formula was proposed, as shown in Appendix D. The gradation recommended for the main cell is slightly finer than that used in the trial, but the same as that used in the original mix design. The binder content was raised from 6.7 to 7.0 percent to improve filling of the voids, thus assuring that desired low permeability could be achieved. Observation of the compaction during construction of the trial section indicated there was no tendency toward tenderness with the higher binder content.

Main Cell Construction

Construction of the main cell was accomplished on October 29, 1991. The adjusted job mix formula was used throughout. The contractor used two crews; one laid the majority of mix with a paving machine, while the other concentrated on hand work around catch basins, buildings, pipes, and other appurtenances. The summary report prepared by Applied Geotechnology Inc., dated November 12, 1991, includes most of the data obtained during construction. Portions of this report are included herein as Appendix E. In addition, Appendix F is the summary of data from testing core samples at Oregon State University.

From the density and permeability data, it was apparent that key design expectations were realized. During the construction, nuclear gage results averaged 99.2 percent of Rice maximum density, while the core samples obtained later averaged 96.7 percent. Assuming the core densities to be "true" values, this average is within the 96 percent (i.e., 4 percent voids) limit. All cores tested for permeability were less than $1x10^{-8}$ cm/sec, including those from cold joints and hand-compacted areas.

The resilient modulus for the core samples averaged 148,000 psi, somewhat less than the 400,000 psi expected prior to the project's inception. The lower modulus resulted from a combination of finer aggregate gradation and high binder content, a compromise required to meet the permeability criteria. In addition, it was discovered that the modulus tests were inadvertently conducted at a temperature somewhat higher than 73°F as specified, resulting in lower values. Because use of the polymer modified binder results in much stiffer mixtures during high summertime temperatures, the pavement strength and stiffness should be more than adequate for the expected use.

Table 2 in Appendix F is a composite of the test data from cores sampled in the main cell area.

Appendix A of Terrel Research Document

POLYMER MODIFIED ASPHALT

As noted in the Owner's Objectives section above, the impermeability of the asphalt cover is of primary concern. For this reason Polymer Modified Asphalt will be used for paving the Site.

Following placement of the rock base course and verification of compaction, 3" of "ECOMAT" Polymer Modified Asphalt shall be placed to the "Top of Asphalt" elevations. Asphalt materials, placement, and compaction shall conform to Weyerhaeuser Company Design Standard C-033 S 1.1 "Asphalt Concrete Surfacing," modified as described below.

Mix Design Requirements

The actual proportioning of the several components to be used in the production of asphalt concrete mixture shall be determined by the Contractor. The surface mixture shall conform to the guideline specifications for ECOMAT, a proprietary (patent pending) design and materials system for environmental applications. The ECOMAT system is one or more layers of a bituminous concrete with the binder usually consisting of a polymer modified asphalt or other material formulated for specific applications. The use of this system is licensed to paving contractors or other construction specialists by Terrel Research. The contractor is required to provide a mixture design proposal to the Owner's Representative that is an approved ECOMAT design. The contractor is directed to the following for further information:

Dr. Ronald Terrel
Terrel Research
9703 241 Place SW
Edmonds, WA. 98020
(206) 542-9223

Mix Design Test Certificate

Contractor shall furnish the Owner with an independent laboratory test report certifying that the mixture supplied conforms to the above specifications. This report shall be approved by Terrel Research and include Quality Control test results.

General Requirements for ECOMAT

1. For this Project the ECOMAT binder shall be a polymer modified asphalt formulated according to the designation ECOMAT 60 and shown in Figure 1. This material may be obtained in Washington State from Chevron Co. (Richmond Beach) or U.S. Oil and Refinery (Tacoma).

2. Aggregate shall be a crushed glacial gravel (or approved equal) similar to that for Class B asphalt concrete (Section 9-03.8 WSDOT Specifications), except that the gradation will be modified for ECOMAT as described below. The final determination of gradation will be made following the evaluation of laboratory test data, based upon compaction and voids and this gradation will become part of the mix design.

3. Binder (ECOMAT) content will be 6.5 to 9.0 percent by weight, as determined in the mix design.

4. Air voids of the compacted ECOMAT mixture shall be 4 percent of less, both in laboratory specimens and field compacted mixtures. Actual compaction effort may be adjusted accordingly.

5. Permeability (k) of laboratory compacted specimens (4 inches diameter by 4 inches high) will be 1 x 10^{-8} cm/sec or less as measured by ASTM D3637 or an equivalent procedure (for example SHRP) and approved by Terrel Research.

6. Resilient modulus (M_R) of laboratory compacted specimens (4 inches diameter by 4 inches high) and core samples shall have a minimum value of 400,000 psi when tested at 73 degrees f (pulse load 0.1 sec., 0.9 sec. rest period), by ASTM 4123-87.

Aggregate Gradation

Aggregate gradation for ECOMAT asphalt shall be as follows:

Sieve size	Percent passing
5/8 in.	100
1/2 in.	96-100
3/8 in.	85-95
1/4 in.	60-80
No. 10	36-50
No. 40	12-25
No. 80	7-15
No. 200	5-10
Mineral Filler	0-2
Asphalt (% of total)	6.5-9.0

Samples

Binder and asphalt binder materials proposed for the Project shall be submitted to the Owner's Representative for testing and approval. The following samples will be submitted for testing:

1.	Asphalt cement	4 ea. 1-qt. cans
2.	Aggregate (composite gradation)	3 ea. 5-gal. cans
	or	2 ea. 5-gal. cans of both coarse and fine fractions from stockpiles
3.	Additives (if any)	1 ea. 1-qt. can

4. Mineral filler (if any) 1 ea. 1-gal. can

When the samples are ready, please contact Ronald Terrel at (206) 542-9223 for shipping instructions.

Field Trials

Before full scale construction, a trial section may be constructed in order to develop an appropriate level of compaction and other procedures for the ECOMAT surface layer. The actual procedure will be developed and directed by the Owner's Representative with the Contractor to assure that an adequate density and roller pattern can be achieved to meet the mixture requirements for ECOMAT asphalt concrete as outlined above. Field density control will be accomplished using suitable calibrated nuclear density devices as approved by the Owner's Representative and conducted by a certified testing laboratory. Core samples will be required to confirm density, void and permeability values (a minimum of 4 pairs = 8 total). Construction of the facility shall not proceed until approved by the Owner's Representative.

Cold Joints

Paving operations shall proceed so that adjacent succeeding passes of the paver occur soon enough to maintain a hot joint. In cases where a cold joint becomes necessary, prior to resuming paving, the existing paving edge shall be thoroughly cleaned with a power broom to remove all debris. Then a tack coat of emulsified asphalt shall be applied using a sprayer or broom. The joint shall then be heated with a propane torch or other suitable heater to a surface temperature of at least 120 degrees F just ahead of the paving machine.

FIGURE 1 -- ECOMAT POLYMER MODIFIED ASPHALT CONCRETE

This asphalt cement shall be modified by the incorporation of polymer. A minimum of 3.0 wt% shall be polymer. The modified asphalt cement shall conform to the following requirements when tested in accordance with the specified test method.

TEST	METHOD	MIN	MAX
Penetration @ 77 deg. F dmm	AASHTO T49	60	100
Viscosity @ 275 deg F cSt	AASHTO T201	--	1000
Softening point, F	AASHTO T53	130	--
Penetration @39.2 deg F, 200g, 60s dmm	AASHTO T49	27	--
Ductility	AASHTO T51	10	--
Properties after RTFO, (AASHTO T240)			
Penetration Ratio @ 77 deg F, Unaged, Aged	AASHTO T49	--	2.2
Penetration @ 39.2 deg. F 200 g, 60s, dmm	AASHTO T49	17	--
Mass Loss, %	AASHTO T240	--	1.0

NOTE: The modified asphalt cement shall be prepared by blending the polymer into the hot asphalt cement at a refinery or terminal at temperatures below 375 deg. F. The modified asphalt cement shall be circulated or agitated for a minimum of one hour per day to ensure continued homogeneity. Storage temperature shall not exceed 375 deg. F. If idle periods exceeding 72 hours are experienced, storage temperature shall be reduced to 325 deg. F or below.

Acceptance

The acceptance of the polymer modified asphalt cement will be based upon the manufacturer's certification of compliance which must include:

1. Copies of the test data showing specific compliance.

2. Identification of polymer, and

3. A statement from the polymer supplier certifying that the polymer and asphalt are compatible.

Appendix B of Terrel Research Document

TERREL RESEARCH

9703 - 241st Pl. S.W.. Edmonds. Washington 98020 U.S.A.
Phone (206) 542-9223
FAX (206)542-6159

October 22, 1991

Mr. Randy Dec
Lakeside Industries
P.O. Box 576
Longview, WA 98632

Re: Weyerhaeuser Facility, #1 Cell Room Site

Dear RAndy:

Enclosed is my suggested mix design for the trial paving tomorrow. In addition, I have included data from our testing at Oregon State University. As we discussed, the laboratory design was low in resilient modulus, but adequate. I expect cores from the mat to be higher.

For the trial strip, which is intended to evaluate the mixture as well as compaction procedures, Figure 4 is a suggested layout. Also, you might consider placing the trial strip across the full width of the site, then succeeding passes could each butt up against it at 90°. This way, a short section of cold joint could be heated during each pass.

Very truly yours,

Ron

Ronald L. Terrel

RLT:am

Enclosures

Mixture Design for Weyerhaeuser Facility, #1 Cell Room Site

Aggregate: Source N-148
Blend Sand: Rainier

October 23, 1991

Sieve	Percent Passing			
	Class 'B'	Ecomat	Lab.Design	Target Trial Design
5/8"	100	100		
1/2"	90-100	96-100	98	96
3/8"	75-90	85-95	90	85
1/4"	55-75	60-80	70	63
#10	32-48	36-50	43	37
#40	11-24	12-25	18.5	14
#80	---	7-15	11	--
#200	3-7	5-10	7.5	5

Binder:
Source: Chevron, Richmond Beach
Grade: Ecomat 60 (PMA-60)
Antistrip: PaveBond Special, 0.25%
Design: 6.7% by wt. of total mix

Mixture: (conducted at Oregon State University)
See attached Tables 1 and 2
Figures 1, 2 and 3

Proposed Trial Design

Aggregate: Target trial design shown above
Binder: 6.7% Ecomat 60
Antistrip: 0.25% Pave Bond Special
Target Air Voids: <4%

Table 1 Summary of Test Results

Specimen no.	Thickness in.	Asph. Cont. %	Air Voids %	MR ksi	Permeability cm/sec,(XE−9)
1	4.47	5.5	14.9	308	30.3
2	4.30	5.5	11.3	295	14.0
3	4.60	6.0	15.7	255	16.3
4	4.30	6.0	9.4	250	7.4
5	4.18	6.5	5.7	240	Impermeable
6	4.26	6.5	8	255	1.2
7	4.25	7.0	7.6	243	0.1
8	4.07	7.0	2.9	217	Impermeable
9	4.07	7.5	2.7	175	Impermeable
10	4.09	7.5	2.1	172	Impermeable
11	4.12	8.0	1.6	157	Impermeable
12	4.08	8.0	0.7	155	Impermeable

Table 2 Summary of Test Results (averages)

Specimen no.	Asph. Cont. %	Air Voids %	MR ksi	Permeability cm/sec,(XE−9)
1	5.5	13.1	302	22.1
2	6.0	12.6	253	11.9
3	6.5	6.9	248	0.6
4	7.0	5.3	230	0.1
5	7.5	2.4	174	0.0
6	8.0	1.2	156	0.0

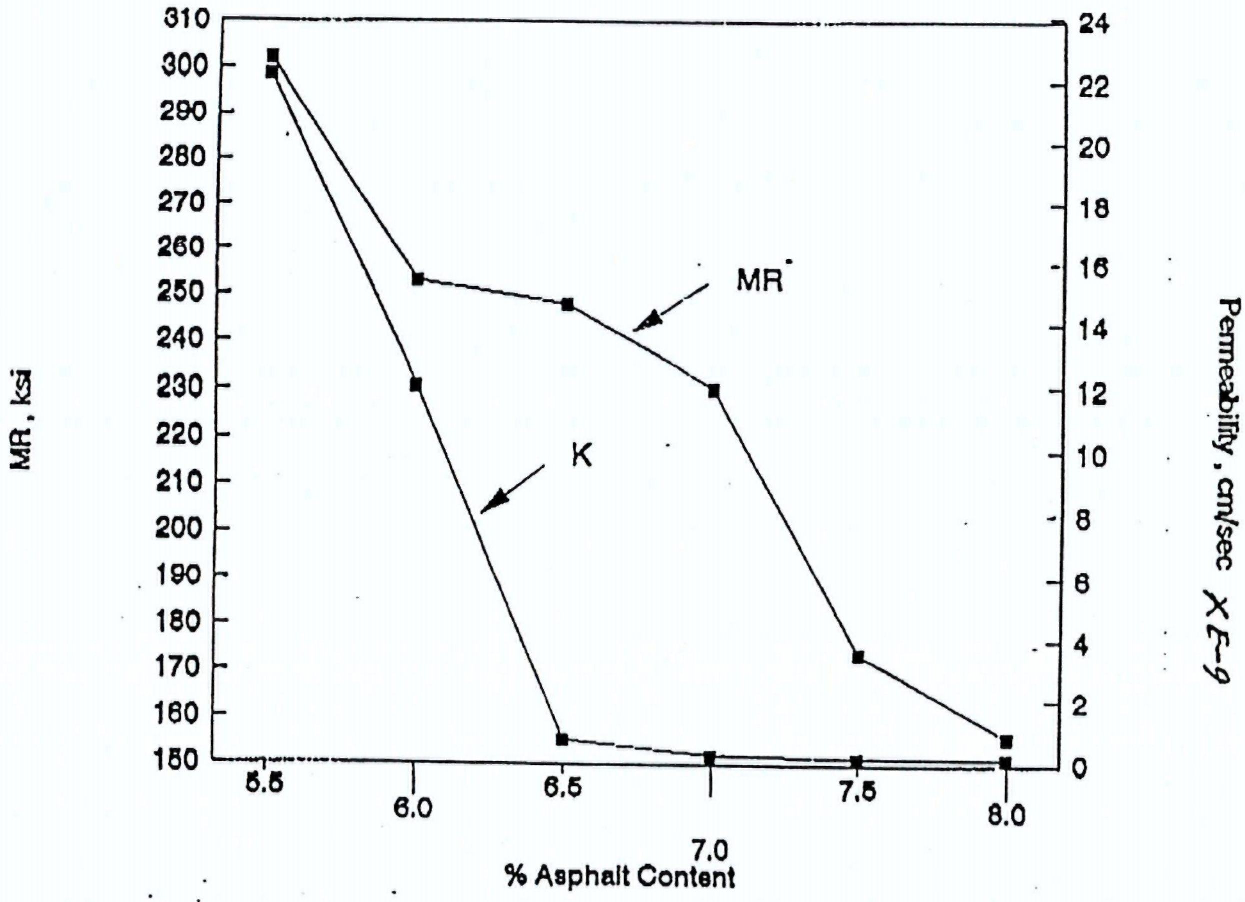


Figure 1 Effects of Asphalt Content on MR and Permeability

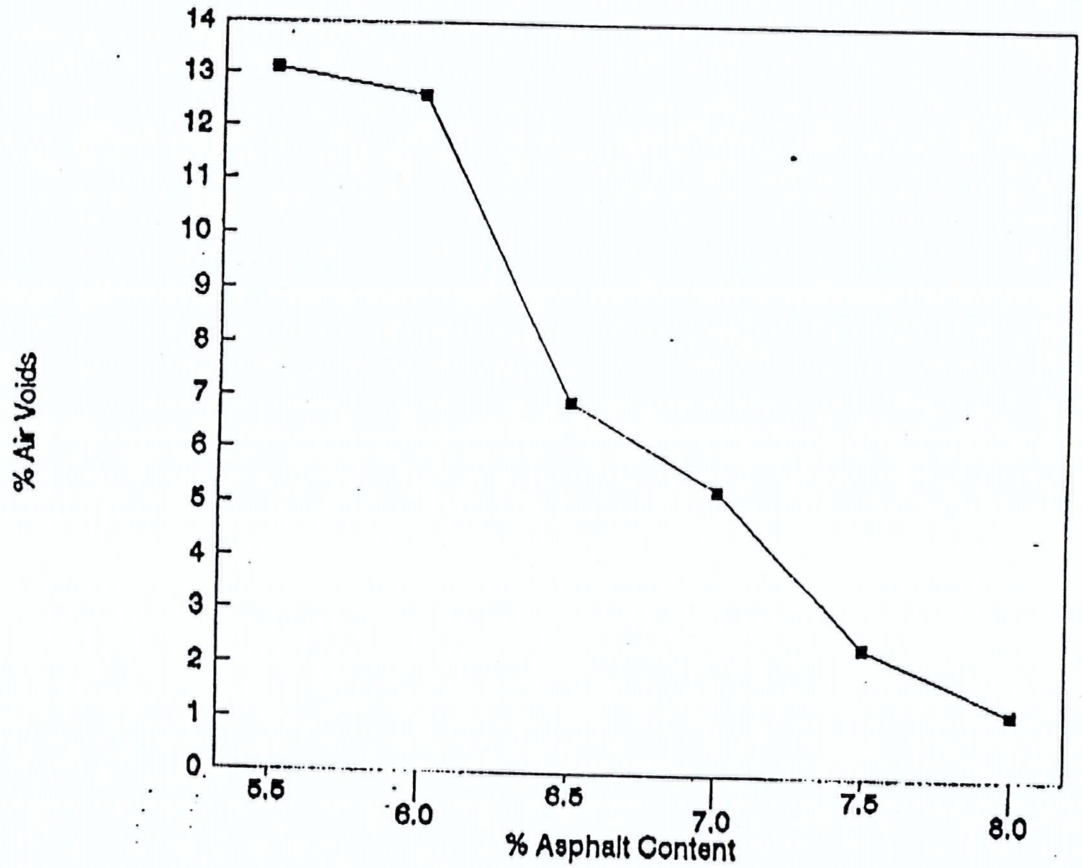


Figure 3 Effects of Asphalt Content on Air Voids

Appendix C of Terrel Research Document

Applied Geotechnology Inc.

TECHNICAL MEMORANDUM

1263.02

To: Ron Kampe
Paul Seamons
Ron Terrel

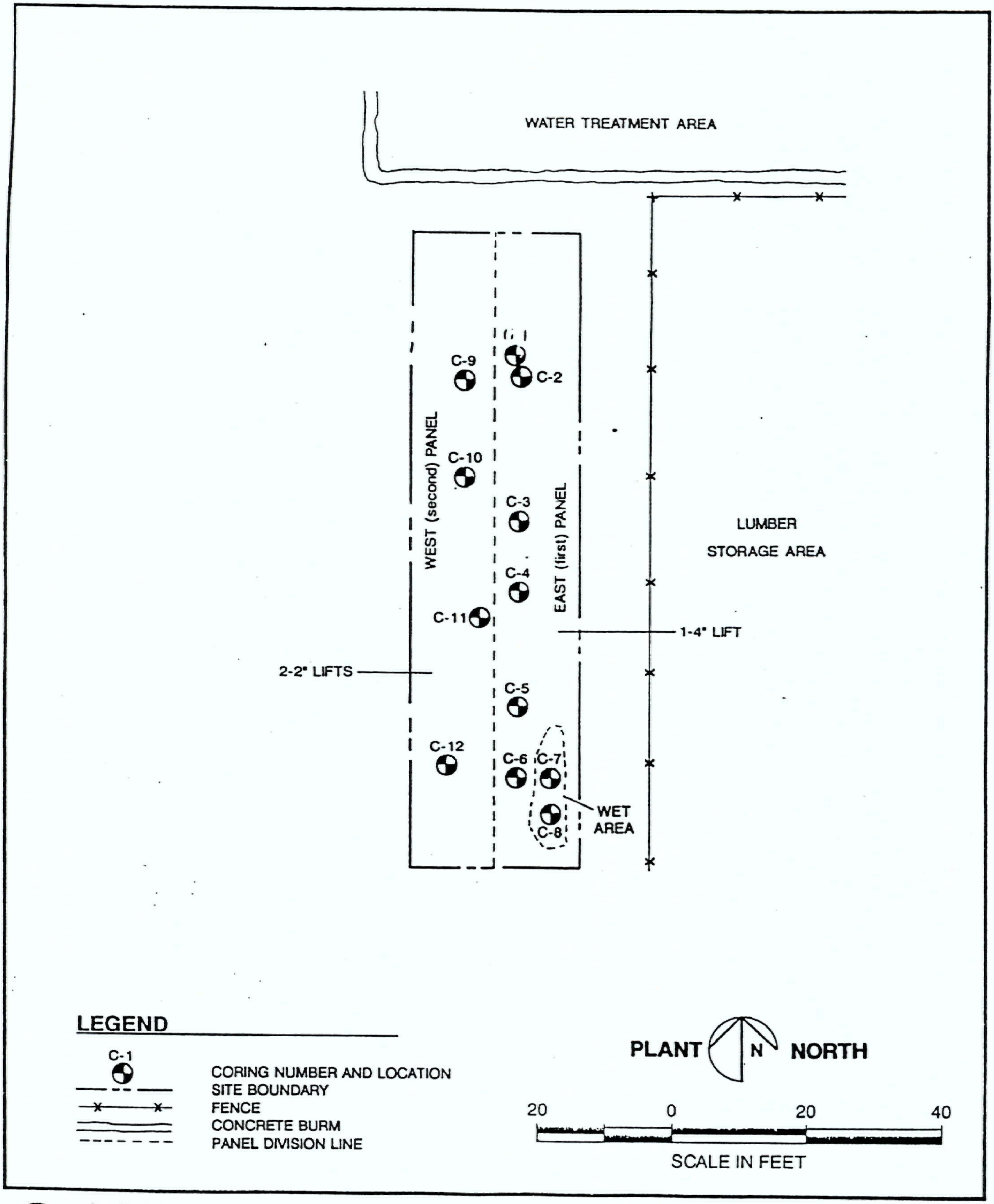
From: Richard Fejta, P.E.

Date: October 25, 1991

Re: Weyerhaeuser Site Capping
Results of Test Paving

- Twelve cores of the test panels were recovered from the site on October 24th. Core locations are presented on Figure 1.
- Core thicknesses ranged from 3.17 inches to 4.24 inches and averaged 3.71 inches.
- Two Rice determinations found theoretical maximum densities of 156.9 pcf and 157.6 pcf. An average Rice maximum density of 157.2 pcf was used to compute the relative percent compaction.
- Based on a the saturated surface dry (SSD) bulk specific gravity (G_s), compaction of the core specimens ranged from 93.9% to 97.2% and averaged 95.2%. Typically, compaction levels increased with increasing compactive effort on the west panel. Interestingly, compaction was not adversely affected by the wet area. In fact, compaction in the wet area was the highest (as measured by the cores and the nuclear density gauge) of all places on the test panels.
- Based on the nuclear density gauge backscatter readings at the core locations, compaction ranged from 93.3% to 100% and averaged 96.4%, suggesting that the backscatter nuclear density tests, on average, read about 1% high. Direct transmission tests within the core holes using a 4-inch probe depth ranged from 92.6% to 97.0% and averaged 94.4%
- Results of the core and nuclear density tests are summarized on the attached data sheet.

2510 S.W. First Avenue Portland, OR 97201 FAX 503/222-0141 Telephone 503/222-2820



Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

SITE PLAN
Weyco Cell Site
Longview, Washington

FIGURE
1

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
1263.01	KPW		10/25/91		

263.02
Weyerhaeuser Site Capping
Results of cores obtained 24 October 1991

Specific Gravity Data

Core Number	Height, Inches	Bulk Gs	Bulk Gs (SSD)	App. Gs	% Absorp.	Unit Wt Bulk Gs	Unit Wt Bulk SSD	Unit Wt Apparent	Bulk SSD % of Rice
1	4.24	2.370	2.388	2.415	0.78	147.9	149.0	150.7	94.7%
2	3.84	2.348	2.375	2.414	1.17	146.5	148.2	150.6	94.2%
3	3.97	2.390	2.407	2.431	0.71	149.1	150.2	151.7	95.5%
4	3.93	2.349	2.373	2.406	1.00	146.6	148.1	150.1	94.1%
5	3.64	2.394	2.411	2.435	0.70	149.4	150.4	151.9	95.6%
6	3.52	2.404	2.425	2.455	0.86	150.0	151.3	153.2	96.2%
7	3.17	2.426	2.449	2.484	0.95	151.4	152.8	155.0	97.2%
8	3.28	2.419	2.437	2.463	0.93	150.9	152.1	153.7	96.7%
9	3.76	2.371	2.384	2.402	0.54	148.0	148.8	149.9	94.6%
10	3.88	2.352	2.370	2.395	0.75	146.8	147.9	149.4	94.0%
11	3.72	2.391	2.404	2.423	0.55	149.2	150.0	151.2	95.4%
12	3.58	2.351	2.367	2.389	0.68	146.7	147.7	149.1	93.9%

Nuclear Density Test Data
Backscatter and 4" Direct Transmission tests

Maximum Theoretical Density
of A.C. (Rice): 157.2 pcf

Core Number	B.S. 1	B.S. 2	4" 1	4" 2	Average B.S.	Average 4"	% Comp. B.S.	% Comp. 4"
1	150.4	148.9	146.2	145.9	149.7	146.1	95.2	92.9
2	150.7	149.1	148.4	148.4	149.9	148.4	95.4	94.4
3	151.0	148.6	148.9	148.9	149.8	148.9	95.3	94.7
4	148.4	150.6	147.7	147.6	149.5	147.7	95.1	93.9
5	153.5	153.4	148.5	149.1	153.5	148.8	97.6	94.7
6	151.0	156.4	152.9	149.1	153.7	151.0	97.8	96.1
7	157.3	157.2	152.9	152.0	157.3	152.5	100.0	97.0
8	156.7	155.2	151.3	149.9	156.0	150.6	99.2	95.8
9	147.5	148.7	147.0	144.2	148.1	145.6	94.2	92.6
10	150.5	149.3	147.5	145.9	149.9	146.7	95.4	93.3
11	148.4	152.2	148.3	148.5	150.3	148.4	95.6	94.4
12	150.0	151.2	147.4	146.5	150.6	147.0	95.8	93.5

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

1263.02

DAILY PLANT REPORT – BITUMINOUS MIXTURES

BI NO.	REPORT NO.	SHEET OF	DATE 23 Oct 91
			CONTRACT NO.

PROJECT NAME (SECTION): Cedding Site

HIGHWAY: 2nd Panel 2 of 4

PROJECT MANAGER:

CONTRACTOR: Lakeside

SUPPLIER: Lakeside

MAKE, MODEL, SIZE OF PLANT:

☐ BATCH ☐ DRUM ☐ CONT.

BRAND & GRADE OF ASPHALT: ECOMAT

MIX CLASS | % RAP

WEATHER CONDITIONS

AM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY

PM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY

MIXTURE USED FOR ☐ LEVELING ☐ BASE ☐ TOP

LOT NO.	SUBLOT OR TEST NO.	LOT NO.	SUBLOT OR TEST NO.
SAMPLED AT	TIME	SAMPLED AT	TIME
TONS REPRESENTED	DAILY TONNAGE AT TIME OF TEST	TONS REPRESENTED	DAILY TONNAGE AT TIME OF TEST

MIX TEMPERATURE

PLANT TIME	°F	ROAD TIME	°F
TIME	°F	TIME	°F

MOISTURE CONTENT

		For Extraction Test	Mixing Plant Discharge	For Extraction Test	Mixing Plant Discharge
1	TARE WT. OF CONTAINER B4	171.0			
2	WET WT. OF CONTAINER & SAMPLE	837.4			
3	DRY WT. OF CONTAINER & SAMPLE	836.6			
4	WET WT. OF SAMPLE [2]−[1]	666.4			
5	DRY WT. OF SAMPLE [3]−[1]	665.6			
6	MOISTURE (([4]−[5])÷[5]) × 100	6a 0.12 %	6b %	6a %	6b %

EXTRACTED AGGREGATE

7	TARE WT. OF CONTAINER A	1933.3	
8	WT. OF DIATOMACEOUS EARTH	? 100.0	
9	WT. OF FILTER PAPER	? 14.0 +1.6 (18.6)	
10	DRY WT. OF AGGREGATE, CONTAINER, DIATOMACEOUS EARTH & FILTER	4089.2	
11	EXTR. AGGR. WT. [10]−([7]+[8]+[9])	2040.3	

EXTRACTED ASPHALT

12	WET WT. OF MIX & CONTAINER	3239.6	
13	TARE WT. OF CONTAINER	1067.5	
14	WET WT. OF MIXTURE [12]−[13]	2172.1	
15	DRY WT. OF MIX ([14]÷(100+[6])) × 100	2169.5	
16	WT. OF EXTRACTED ASPHALT [15]−[11]	129.2	
17	ASPHALT IN MIX ([16]÷[15]) × 100	6.0 %	%

JOB MIX FORMULA & LAB. NO. / AGGREGATE GRADATION

PASS SIEVE	TARGET %	LSL — USL	PASS SIEVE	RETAINED WT.	% RET.	% PASS	RETAINED WT.	% RET.	% PASS
1"			1"						
¾"			¾"	0.0	0	100			
⅝"			⅝"	104.7	5	95			
¼"			¼"	813.2	40	60			
10			10	1426.4	70	30			
40			40	1762.1	86	14			
200			200	1920.6	94.1	5.9			
ASPHALT			PAN	2138.4					
			TOTAL	− 100.0 + 3.0 = 2041.1					

MIX PRODUCTION SUMMARY (TONS)

	THIS REPORT	CUMULATIVE
SPEC. MIX INCORP. (TONS)		
NON-SPEC. INCORP. (TONS)		
TOTAL INCORP. (TONS)		

TIME SHIFT STARTED | TIME SHIFT ENDED

AVERAGE PRODUCTION RATE TONS/HR.

SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET

SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET

REMARKS: (LIST TIME & EXTENT OF DELAYS, PLANT CHANGES, ETC.)

DISTRIBUTION: PROJECT MANAGER, REGION, ORIGINATOR & CONTRACTOR.

PREPARED BY: [signature] / LAN

REVIEWED BY CONTRACTOR

REVIEWED BY PROJECT MANAGER

734-0043 (REV. 1-88)

PROJECT MANAGER

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

1263.02

DAILY PLANT REPORT — BITUMINOUS MIXTURES

PROJECT NAME (SECTION)	Weyco Capping Site
HIGHWAY	1st Panel, 2 of 4
BI NO.	
REPORT NO.	
SHEET OF	
DATE	10/23/91
PROJECT MANAGER	
CONTRACTOR	
SUPPLIER	
CONTRACT NO.	
MAKE, MODEL, SIZE OF PLANT	☐ BATCH ☐ DRUM ☐ CONT.
BRAND & GRADE OF ASPHALT	ECONAT
MIX CLASS	
% RAP	

WEATHER CONDITIONS

AM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY
PM ____ °F ☐ FAIR ☐ RAIN ☐ CLOUDY ☐ WINDY

MIXTURE USED FOR ☐ LEVELING ☐ BASE ☐ TOP

LOT NO.	SUBLOT OR TEST NO.	LOT NO.	SUBLOT OR TEST NO.
SAMPLED AT	TIME	SAMPLED AT	TIME
TONS REPRESENTED	DAILY TONNAGE AT TIME OF TEST	TONS REPRESENTED	DAILY TONNAGE AT TIME OF TEST

MIX TEMPERATURE

PLANT: TIME ____ °F; TIME ____ °F
ROAD: TIME ____ °F; TIME ____ °F

MOISTURE CONTENT

			For Extraction Test	Mixing Plant Discharge	For Extraction Test	Mixing Plant Discharge
1	TARE WT. OF CONTAINER	C-1	165.5			
2	WET WT. OF CONTAINER & SAMPLE		1151.2			
3	DRY WT. OF CONTAINER & SAMPLE		1150.5			
4	WET WT. OF SAMPLE [2]−[1]		985.7			
5	DRY WT. OF SAMPLE [3]−[1]		985.0			
6	MOISTURE ([4]−[5])÷[5] × 100		6a 0.07 %	6b %	6a %	6b %

C. TEST RESULTS — CIRCLE ALL NON

EXTRACTED AGGREGATE

7	TARE WT. OF CONTAINER	C	1678.4	
8	WT. OF DIATOMACEOUS EARTH		100.0	
9	WT. OF FILTER PAPER		13.1+1.6= 14.7 (17.6)	
10	DRY WT. OF AGGREGATE, CONTAINER, DIATOMACEOUS EARTH & FILTER		3649.7	
11	EXTR. AGGR. WT. [10]−([7]+[8]+[9])		1856.6	

EXTRACTED ASPHALT

12	WET WT. OF MIX & CONTAINER	3042.3	
13	TARE WT. OF CONTAINER	1067.7	
14	WET WT. OF MIXTURE [12]−[13]	1974.6	
15	DRY WT. OF MIX ([14]÷(100+[6])) × 100	1973.2	
16	WT. OF EXTRACTED ASPHALT [15]−[11]	116.6	
17	ASPHALT IN MIX ([16]÷[15]) × 100	5.9 %	%

JOB MIX FORMULA & LAB. NO. / AGGREGATE GRADATION

PASS SIEVE	TARGET %	LSL — USL	PASS SIEVE	RETAINED WT.	% RET.	% PASS	RETAINED WT.	% RET.	% PASS
1"			1"						
¾"			¾"	0.0	0	100			
½"			½"	148.9	8	92			
¼"			¼"	689.2	37	63			
10			10	1287.2	69	31			
40			40	1609.6	87	13			
200			200	1764.5	95.0	5.0			
ASPHALT			PAN	1854.9					
			TOTAL	−100+ 2.9 = 1857.8					

SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET

SPECIFIC GRAVITY OF THIS SAMPLE FROM TM 306-A(F) WORKSHEET

MIX PRODUCTION SUMMARY (TONS)

	THIS REPORT	CUMULATIVE
SPEC. MIX INCOMP. (TON)		
NON-SPEC. INCOMP. (TON)		
TOTAL INCOMP. (TON)		

TIME SHIFT STARTED ____ TIME SHIFT ENDED ____

AVERAGE PRODUCTION RATE ____ TONS/HR.

REMARKS: (LIST TIME & EXTENT OF DELAYS, PLANT CHANGES, ETC.)

DISTRIBUTION: PROJECT MANAGER, REGION, ORIGINATOR & CONTRACTOR.

PREPARED BY M Nelson / LAN

REVIEWED BY CONTRACTOR

REVIEWED BY PROJECT MANAGER

734-3063 (REV. 1-86)

PROJECT MANAGER

Applied Geotechnology Inc.

Geotechnical Engineering
Geology & Hydrogeology

2510 SOUTHWEST FIRST AVENUE
PORTLAND, OREGON 97201
503-222-2820

PROJECT MEMORANDUM

Date: 10/23/91

File: 1263.02

To: R. Kampe, R. Terrel, P. Seamons, File

From: Richard Fejta

Project: Weyerhaeuser Cell Site

Subject: Test Paving

☐ Telephone Call ☐ Conference ☒ Site Visit ☐ Other

1) Arrived on site as arranged at 9:00 am to observe test paving. Performed seven density tests of subgrade in test area. Compaction averaged 96.3%. Please refer to attached sheet 3/5 for details.

2) Paving contractor (Lakeside Industries) began test panels at approximately 10:45 am. The first (east) panel was one 4-inch thick lift. Test results are summarized below.

PANEL SECTION	COMPACTIVE EFFORT	Avg. % COMPACTION
North Third	2 static passes	92.4%
Middle Third	2 static & 2 vibratory passes	95.5%
South Third	2 static & 4 vibratory passes	95.7%

please refer to sheet 4/5 for details

Distribution:

By: RPF

Applied Geotechnology Inc.

Geotechnical Engineering
Geology & Hydrogeology

2510 SOUTHWEST FIRST AVENUE
PORTLAND, OREGON 97201
503-222-2820

PROJECT MEMORANDUM

Date: 10/23/91

File: 1263.02

To:

From:

Project:

Subject:

☐ Telephone Call ☐ Conference ☐ Site Visit ☐ Other

3) The second (west) panel was placed in 2, 2-inch thick lifts. The first lift was compacted with 4 and 6 static passes of the steel drum roller. The second lift was compacted with 4 vibratory passes. Density test results on the second lift ranged from 94.3% to 96.4% of the Rice maximum density and averaged 95.3%. Refer to sht. 5/5 for details.

4) Temperatures of the asphalt ranged from approximate 300°F initially (1st panel, 1st pup) cooling to 240°F w/ the first truck and 230°F with the second truck and pup.

5) Arranged to return to site tomorrow to perform coring of test panels. Production paving tentatively scheduled for Tuesday 10/29/91.

6) Performed two Rice Max densities. Results were 156.9 pcf, 157.6 pcf. Avg. = 157.2 pcf.

Distribution:

By: Richard Fejta

NUCLEAR GAU . TESTS

DATE STARTED: 10/23/91
DATE COMPLETED: 10/23/91
STANDARD COUNTS: moisture 648
density 2831

Applied Geotechnology Inc.
2510 S.W. First Avenue
Portland, Oregon 97201

PAGE 3 OF 5
JOB NO. 1263.02
JOB NAME Weyco Site Cap
HRS. USED 6 TESTED BY RPF

TEST NO.	LOCATION	DEPTH from	PROBE DEPTH	DENSITY count	DENSITY wet	DENSITY dry	MOISTURE count	MOISTURE pcf	MOISTURE %	SAMPLE NO.	MATERIAL TYPE	MAXIMUM DENSITY STD/MOD	% COMPACTION
	Basecrock Tests prior to placement of ECOMAT												
	E.5 - line	Subgrade		BS	140.8	132.3	112		6.4		1/2"-0	141.0	93.9
	wet area @ E-line	"		8"	149.1	136.4	157		9.3		"	"	96.7
	wet area @ E-line	"		8"	152.7	140.7	150		8.5		"	"	99.8
	D-line	"		8"	142.9	133.5	123		7.5		"	"	94.6
	G-line	"		8"	141.3	134.8	92		4.8		"	"	95.6
	H-line	"		8"	139.8	133.2	92		4.9		"	"	94.5
	H-line	"		BS	149.5	139.3	130		7.3		"	"	98.8
												$\bar{X}$ =	96.3%

MATERIAL TYPES:

REMARKS: 96.3% x 141.0 = 135.7 pcf

NUCLEAR GAUGE TESTS

Applied Geotechnology Inc.
2510 S.W. First Avenue
Portland, Oregon 97201

DATE STARTED: 10/23/91
DATE COMPLETED: 10/23/91
STANDARD COUNTS: moisture 648
density 2831

JOB NO. 1263.02
JOB NAME Weyco Cell Site
HRS. USED
TESTED BY RPF
RICE

TEST NO.	LOCATION	DEPTH from	PROBE DEPTH	DENSITY count	DENSITY wet	DENSITY dry	MOISTURE count	MOISTURE pcf	MOISTURE %	SAMPLE NO.	MATERIAL TYPE	MAXIMUM DENSITY ~~STD/MOD~~	% COMPACTION
	First (EAST) PANEL												
	North Third (2 static passes)		B.S.	825	132.7		95		5.4		ECOMAT	157.2	84.4 *
	" " " " " " "		B.S.	694	145.3		93		4.8		"	"	92.4
	Middle Third (2 static passes 2 vib. passes)		B.S.	641	151.6		110		5.7		"	"	96.4
	" " " "		B.S.	665	148.7		96		4.9		"	"	94.6
	South Third (2 static passes 4 vib. passes)		B.S.	654	150.0		102		5.2		"	"	95.4
	" " " " " "		B.S.	645	151.0		99		5.0		"	"	96.0

MATERIAL TYPES: ECOMAT

Equipment: BLAW-KNOX PF 500 Paver
Dynapac 42A Compactor

REMARKS: 2 Trucks w/ pups

Temperature: 1^{ST} Pup = 302°F
1^{ST} Truck = 240°F

* disregard test result

PAGE 5 OF 5

NUCLEAR GAU TESTS

DATE STARTED: 10/23/91

DATE COMPLETED: 10/23/91

STANDARD COUNTS: moisture 648

density 2831

Applied Geotechnology Inc.
2510 S.W. First Avenue
Portland, Oregon 97201

Thin Lift correction

JOB NO. 1263.02

JOB NAME Weyco Cell Site

HRS. USED

TESTED BY RPF RICE

TEST NO.	LOCATION	DEPTH from	PROBE DEPTH	DENSITY count	DENSITY wet	DENSITY ~~dry~~	MOISTURE count	MOISTURE pcf	MOISTURE %	SAMPLE NO.	MATERIAL TYPE	MAXIMUM DENSITY ~~STD/MOD~~	CORRECTED % COMPACTION
	SECOND (WEST) PANEL												
N. 1/3	First Lift (4 static passes)	2"	B.S.	730	141.5	142.6	88		4.6		ECOMAT	157.2	90.7
S. 1/3	" " " "	2"	B.S.	682	146.6	147.7	100		5.2		"	"	93.9
M. 1/3	" " " "	2"	B.S.	720	142.5	143.6	86		4.4		"	"	91.3
M. 1/3	First Lift (6 static passes)	2"	B.S.	684	146.4	147.5	100		5.2		"	"	93.8
N. 1/3	" " " "	2"	B.S.	666	148.6	149.7	91		4.5		"	"	95.2
	SECOND LIFT (4 Vib passes)												
	North Third	4"	B.S.	667	148.4		101		5.2		"	"	94.4
	" "	4"	B.S.	641	151.6		103		5.3		"	"	96.4
	Middle Third	4"	B.S.	650	150.5		98		5.0		"	"	95.7
	" "	4"	B.S.	651	150.4		93		4.6		"	"	95.7
	South Third	4"	B.S.	668	148.2		108		5.7		"	"	94.3
	" " " "	4"	B.S.	655	149.8		104		5.4		"	"	95.3

MATERIAL TYPES:

REMARKS:

TEMPERATURES:

1st LIFT (Pup) 205°-230°

2nd Lift (Truck) 230°

Appendix D of Terrel Research Document

Adjusted Job Mix Formula

Weyerhaeuser Facility, #1 Cell Room Site

Aggregate: Source N-148 October 28, 1991
Blend Sand: Rainier

Percent Passing

Sieve	Class 'B'	Ecomat	Lab.Design	Trial Section	Adjusted JMF
5/8"	100	100		100	
1/2"	90-100	96-100	98	93	98
3/8"	75-90	85-95	90	--	90
1/4"	55-75	60-80	70	62	70
#10	32-48	36-50	43	30	42
#40	11-24	12-25	18.5	14	18
#80	---	7-15	11	--	--
#200	3-7	5-10	7.5	5.9	7

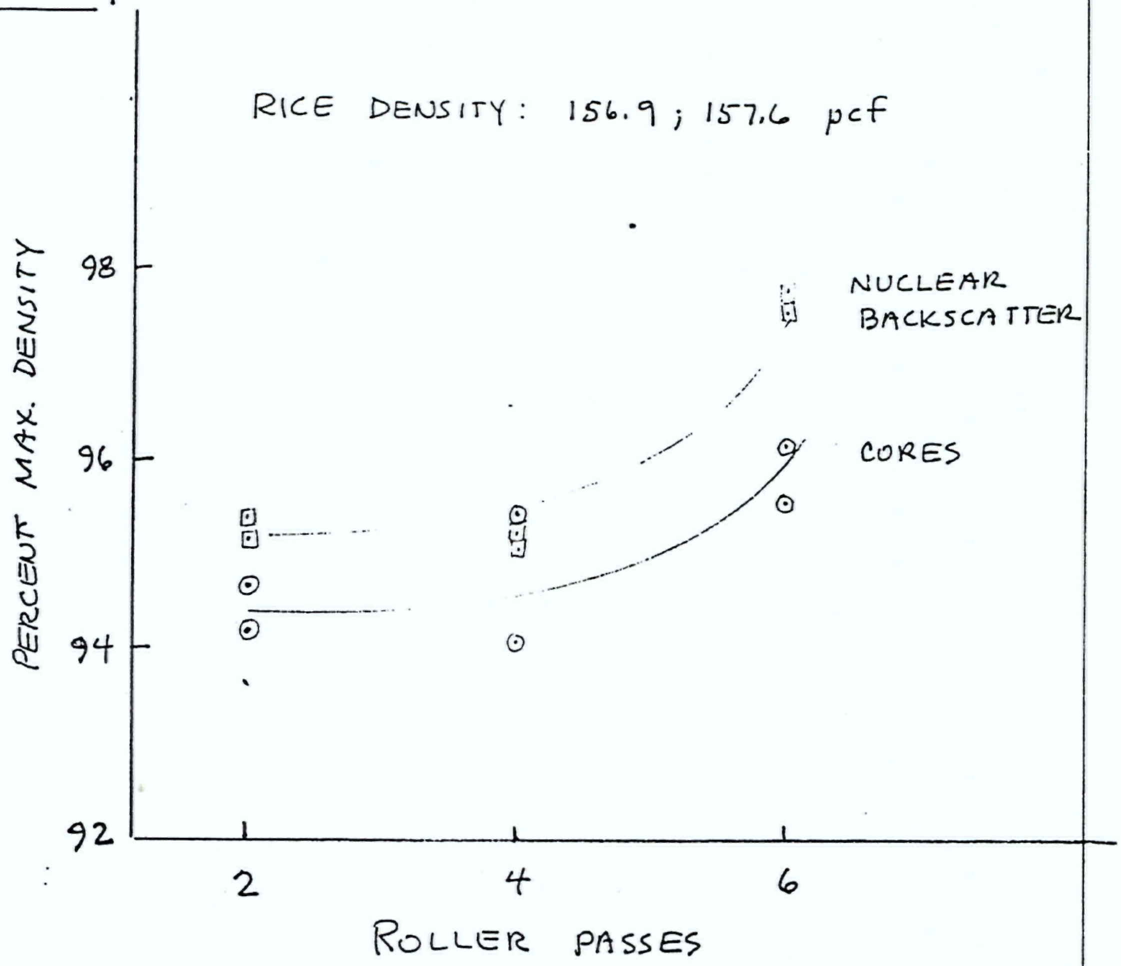
Binder: Source: Chevron, Richmond Beach
Grade: Ecomat 60 (PMA-60)
Antistrip: PaveBond Special, 0.25%
Lab. Design: 6.7% by st. of total mix

Revised Job Mix Formula

Aggregates: Adjusted JMF design shown above
Binder: 7.0% Ecomat-60
Antistrip: 0.25% PaveBond Special
Target Air Voids: $<$ 4%

SUMMARY OF TEST RESULTS FROM TRIAL SECTION
PAVED OCT. 23, 1991

DENSITY :



BINDER CONTENT : 5.9 %

GRADATION : SEE REVISED JMF

THICKNESS : 3.17 – 4.24 in. , Avg : 3.71

Appendix E of Terrel Research Document

Applied Geotechnology Inc.

November 11, 1991

1263.02

Mr. Ron Kampe
Kampe Associates Inc.
3681 S.W. Carman Drive
Lake Oswego, OR 97035

**SUMMARY OF QUALITY CONTROL SERVICES DURING CONSTRUCTION
#1 CELL ROOM SITE GRADING AND PAVING
WEYERHAEUSER - LONGVIEW, WASHINGTON**

Dear Ron:

As requested, presented herein is summary of the geotechnical and pavement quality control services performed for the above-referenced project. The principle findings of our work is summarized below. Supporting field and laboratory data are presented in the Appendices.

- The placement of import sand fill and base rock was observed and tested by representatives from this office between October 9 and October 21, 1991. Numerous nuclear field density tests were performed on the import fill material. Based on the testing and observations, it is our opinion that the import fill materials were placed in accordance with the specifications (i.e., compaction to 95% of the modified Proctor maximum density). Please refer to our daily field memoranda for details.

- Test panels of polymer-modified asphaltic concrete were constructed at the site on October 23, 1991. Test measurements and core results for the test panels were presented in our Technical Memorandum dated October 25, 1991. This information is reproduced in Appendix A for your reference.

- Four Rice determinations from samples recovered during the production paving found theoretical maximum densities of 155.4, 154.5, 155.5 and 154.9 pcf. An average Rice maximum density of 155.1 pcf was used to compute the relative percent compaction. Rice maximum density laboratory determinations are presented in Appendix B.

2510 S.W. First Avenue Portland, OR 97201 FAX 503/222-0141 Telephone 503/222-2820

- Continuous observation and testing with a nuclear density gauge was performed during the production paving on October 29, 1991. Temperatures of the asphalt were found to range from 250 to 325 degrees with an average of approximately 296 degrees. 107 nuclear density tests were performed at 50 to 100-foot intervals as paving progressed.

- Field density testing with the nuclear gauge indicated compaction of the asphalt ranged from 93.1% to 104% of the average Rice maximum density. The average compaction (average of 107 nuclear densiometer tests) was 99.2%. Core test results (see below) indicate the nuclear density test values are 2.3 percent high on average. Field density testing locations are presented on Figure 1. Field memorandum for the production paving along with nuclear density test data sheets are presented in Appendix C.

- 20 cores (10 sets of 2 each) were recovered from the site on November 1st. Core locations were approved prior to coring and are presented on Figure 2.

- Core thicknesses ranged from 3.34 inches to 4.90 inches and averaged 4.14 inches.

- Based on a the saturated surface dry (SSD) bulk specific gravity (G_s), compaction of the core specimens ranged from 95.1% to 98.2% and averaged 96.7% (average of 9 tests).

- Results of the coring (core thickness, specific gravity determinations, and compaction) are summarized in Appendix D. Nuclear density tests were also performed at all core locations (prior to coring) for comparison and this information is included in Appendix D.

- Permeability and Resilient Modulus testing of the production cores was performed by Terrel Research. Test results are summarized in Appendix E.

- All core locations (including the test pavement cores) were patched as recommended by the pavement designers using a non-shrink grout (CONBEXTRA S).

We trust this information is sufficient for your needs. If you have any questions, please call.

Very truly yours,

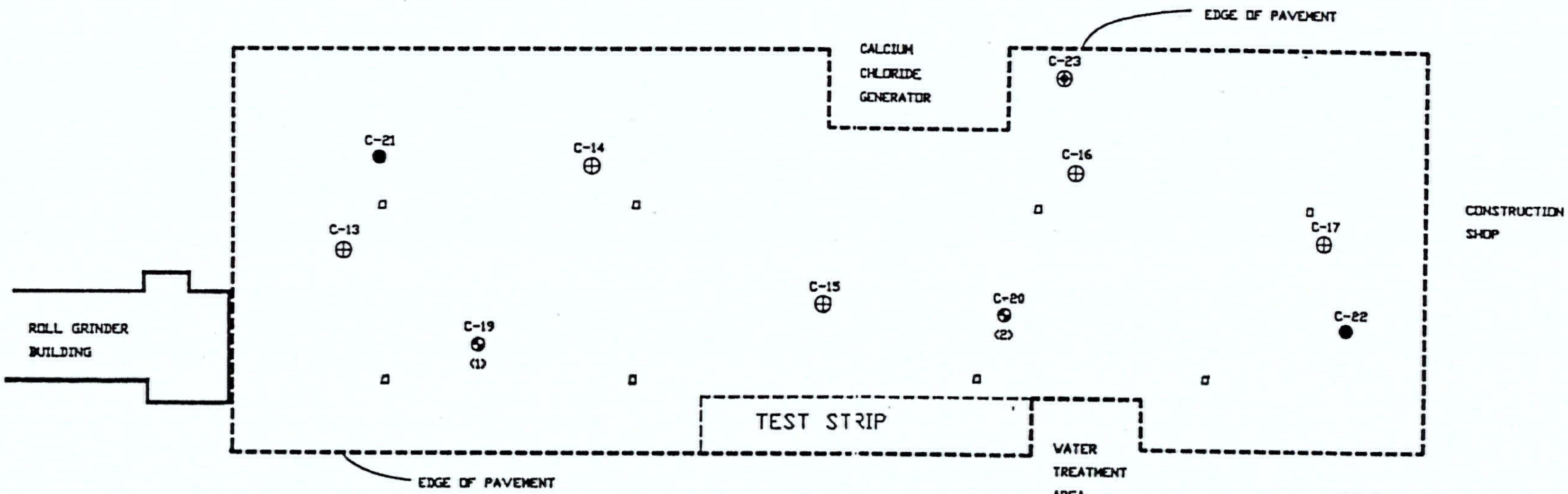
Applied Geotechnology Inc.

Richard P. Fejta

Richard P. Fejta, P.E.

RICHARD P. FEJTA
STATE of WASHINGTON
25484
REGISTERED
PROFESSIONAL ENGINEER

RPF:bm



LEGEND

C-13 CORE SET SELECTED BY RANDOM NUMBER TABLE

C-19 CORE SET AT HOT JOINT

C-21 CORE SET IN COLD JOINT

C-23 CORE SET IN HAND COMPACTED AREA

NOTES

(1) Between 6th and 7th N - S panel.
(2) Between 7th and 8th N - S panel.

SCALE: 1" = 50'

PLANT GRID NORTH

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

CORE LOCATION PLAN
Cell Site Paving
Longview, Washington

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
1263.02	CMP		10/31/91		

1263.02
Weyerhaeuser Site Capping
Results of cores obtained November 1, 1991

Core Number	Height, Inches	Bulk Gs	Bulk Gs (SSD)	App. Gs	% Absorp.	Unit Wt Bulk Gs	Unit Wt Bulk SSD	Unit Wt Apparent	Bulk SSD % of Rice
13	3.60	2.415	2.420	2.429	0.24	150.7	151.0	151.6	97.4
14	4.47	2.413	2.419	2.427	0.22	150.6	150.9	151.4	97.3
15	4.58	2.436	2.440	2.446	0.16	152.0	152.3	152.6	98.2
16	3.97	2.375	2.382	2.392	0.29	148.2	148.6	149.3	95.8
17	3.85	2.371	2.383	2.399	0.48	148.0	148.7	149.7	95.9
19	4.90	*	*	2.374	*	*	*	148.1	
20	4.58	2.372	2.385	2.403	0.54	148.0	148.8	149.9	96.0
21	4.54	2.436	2.440	2.447	0.18	152.0	152.3	152.7	98.2
22	3.34	2.344	2.363	2.390	0.82	146.3	147.5	149.1	95.1
23	3.52	2.404	2.411	2.421	0.29	150.0	150.4	151.1	97.0
									======
					Average core compaction =				96.75%

Summary of Backscatter Nuclear Density Tests

Maximum Theoretical Density
of A.C. (Rice): 155.1

Core Number	B.S. 1	B.S. 2	Average B.S.	% Comp. B.S.
13	155.8	154.3	155.1	100.0
14	154.9	155.8	155.4	100.2
15	159.4	157.9	158.7	102.3
16	154.6	154.3	154.5	99.6
17	151.6	149.8	150.7	97.2
19	144.2	146.4	145.3	93.7
20	155.4	153.1	154.3	99.5
21	153.2	155.3	154.3	99.5
22	154.4	153.9	154.2	99.4
23	153.8	153.1	153.5	98.9
				======
Average backscatter compaction =				99.01%

Appendix F of Terrel Research Document

2/3

Table 1 Summary of Test Results

Specimen no.	Thickness in.	Resilient Modulus ,ksi			Permeability cm/sec,(XE−9)
		Side A	Side B	Av. MR	
C−13A	2.23	200	217	209	Impermeable
C−14A	4.00	145	140	143	Impermeable
C−15A	3.89	148	140	144	Impermeable
C−16A	3.58	154	150	152	Impermeable
C−17A	3.16	119	103	111	7.78
C−18A					
C−19A	3.19	159	168	164	2.88
C−20A	4.00	154	160	157	Impermeable
C−21A	3.88	105	103	104	Impermeable
C−22A	3.00	127	130	129	0.56
C−23A	3.15	160	170	165	Impermeable

Permeability Test :

Spec. no.	Differential Pressure .in. Hg				Flow Rate ,cf/h			
C−17A	1.4	2.4	3	3.6	6	8	9	10
C−19A	3	4.1	6.5	−	2	3.5	4.5	−
C−22A	0.85	3.2	6	−	200 cc/min	400 cc/min	540 cc/min	−

TABLE 2 - Summary of test data from core samples.

Core No.[a]	Thickness (in.)	Resilient Modulus ksi	Density,[b] % max.	Voids %	Permeability cm/sec x 10^{-9}	Notes
13	3.60		97.4	2.6		
13A		209			0[c]	Random location
14	4.47		97.3	2.7		
14A		143			0	" "
15	4.58		98.2	1.8		
15A		144			0	" "
16	3.97		95.8	4.2		
16A		152			0	" "
17	3.85		95.9	4.1		
17A		111			7.78	" "
19	4.90		--	--		
19A		164			2.88	Hot Joint
20	4.58		96.0	4.0		
20A		157			0	" "
21	4.54		98.2	1.8		
21A		104			0	Cold Joint
22	3.34		95.1	4.9		
22A		129			0.56	Cold Joint
23	3.52		97.0	3.0		
23A		165			0	Hand Compacted
Avg.	4.14	148	96.75	3.25		

Notes: a. Cores with 'A' designation were tested at Oregon State University
b. Max. density (Rice) = 155.1 lb/cf
c. Impermeable to air @ 20-in. Hg vacuum